Insure VICTORY ... Buy Bonds for War ... Push Plans for Peace

Contractors and Engineers Monthly

Vol. 41, No. 8 AUGUST, 1944 $2 a Year, 20 Cents a Copy

Highlights Of This Issue

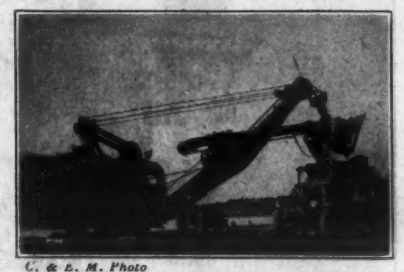
Airport Expansion
The need for greatly expanded facilities at Stewart Field, N.Y., the training field for Air Cadets at West Point, resulted in a construction project involving the installation of additional drainage, and both concrete and asphalt paving, all done by the contractor while the field was in use for training. As part of the work to increase facilities at a West Coast Naval Air Station, a concrete apron was paved prior to the erection of a new hangar. See pages 1 and 57.

Work at Shasta Dam
One of the later operations at Shasta Dam was the plugging of the tunnel through the dam which carried first the railroad and then the diverted Sacramento River during construction.
See page 2.

Well-Planned Equipment Shops
Two examples of well-planned equipment shops and the value of a regular check-up of equipment are described in this issue. One is at the U. S. Naval Training Station at Great Lakes, Ill., and the other is the third in our series on how the U. S. Forest Service cares for its equipment. See pages 11 and 61.

Winter Road Maintenance
Highway maintenance in any season is more difficult than in pre-war days, but the problems of keeping our main highways open during the winter storms ahead are looming up ominously, and should be faced now—not when they get here. Several phases of winter maintenance are discussed in this issue: how Minnesota "defrosts" the culverts along state highways; how North Dakota has met the wartime problems of open roads in winter with a depleted personnel; and how Vermont has used rock salt effectively in snow removal and ice control. See pages 20, 29 and 83.

IN THIS ISSUE



C. & E. M. Photo
A Northwest 2-yard shovel excavated trench for the reinforced-concrete drainage pipe at Stewart Field, N.Y.

A New Access Road In Texas Panhandle

Double Surface Treatment On Caliche Base Laid on 7.6 Miles Near Dalhart By McKinney Constr. Co.

✦ DURING the autumn and winter of 1943-44, the McKinney Construction Co. of Marshall, Texas, built a 7.6-mile access road near Dalhart for the Texas Highway Department. The work, which consisted of a double bituminous surface treatment on a flexible base, was done under adverse conditions of weather and heavy traffic movement to a Government war facility, greatly delaying its completion, but the job was finished and accepted in the spring of 1944.

Grading

The new roadway has crown widths of from 30 to 34 feet, with side slopes varying from a minimum of 10 to 1 to a maximum of 6 to 1. Five 12-cubic-yard Tournapulls and two 12-cubic-yard LeTourneau scrapers pulled by Caterpillar D8 tractors handled the grading.
(*Continued on page* 30)

Subgrade Treatment, Drainage and Paving For Stewart Field, N.Y.

By THEODORE REED KENDALL, Editor

(*Photos on page* 88)

Preparation for Paving Of Runways and Take-Off Mat of 94 Acres with a Total of 80 Paved Lanes

✦ STEWART Field near Newburgh, N. Y., was built to speed the training of West Point cadets in flying. Because every minute in a training plane should be put to the best use, and a single runway for take-offs slows the progress of a squadron of a dozen or more planes, the take-off was paved 2,000 feet square with two 6,000-foot runways 150 feet wide extending through it and connected by peripheral taxiways. Thus ten or more training planes can wheel into line and take off at the same time.

The preparation of the subgrade for this huge concrete mat, the teaming up of large concrete pavers for the actual paving, and the method of providing drainage, with the problems of keeping the field in operation, since training could not be stopped while a trench was dug, add to the story of planning this huge construction project recently completed.

Stabilization

The original contract for the excavation of the subgrade material to a suitable depth for backfilling with selected material and the grading of the field was for 3,500,000 cubic yards, supplemented by a later contract for an additional 1,000,000 cubic yards.

The subgrade material is a tough heavy blue clay not easy to move with scrapers when dry and like rubber when wet. A total of 700,000 cubic yards of this material was excavated by scrapers in areas where density and bearing tests showed that it could not support the eventual loads to be placed on the runways. Excavation was carried to a depth of 6 feet and the area backfilled with bank-run gravel in 6-inch layers compacted by sheepsfoot rollers right up to the established field subgrade elevation. General fill was placed in 12-inch layers, using pit-run gravel, and all cut areas were backfilled in 6-inch layers. Where backfilling the areas to be stabilized, Proctor bearing and density tests were run continuously right up to the top layer, to be certain that the final 6-foot backfili was strong enough to carry the anticipated loads. If the completed fill did not meet the required tests, the entire fill was taken out and started over. The 6 feet of excavation over the blue clay provided a sufficient depth of backfill to spread the load over the clay enough to insure the area against any failure.

The stabilizing gravel was selected with great care, although pit-run material was used. The loading was done by power shovels working against the face of the pits in such a manner as to mix completely any strata of coarse and fine material. There were eight such pits located from 3 to 9 miles from the field, requiring a large fleet of trucks to han-
(*Continued on page* 46)

SUCH DRIFTS AS THIS MAY OCCUR ON YOUR ROADS NEXT WINTER—PREPARE NOW

A buried passenger car is indicated by the arrow and flag in the photo on the left; at the right, a Snogo of the North Dakota State Highway Department stops just as it reaches the buried car. See page 29.

Diversion Tunnel Plugged As Shasta Nears Completion

Concrete Pumped Through Long Line and High Lift To Close Dual-Purpose Temporary Tunnel

By FRANK B. SARLES,
Western Field Editor

(*Photos on page* 88)

✦ ONE of the later operations at Shasta Dam, a major structure in the Bureau of Reclamation's Central Valley Project in California, was the plugging of an 1,800-foot tunnel built under a separate contract during the early stages of the work. This tunnel served the dual purpose of providing a new route for the main San Francisco-Portland line of the Southern Pacific railroad pending the completion of the extensive relocation and rebuilding program required by the construction of Shasta Dam (See C. & E. M. Oct., 1939, pg. 2 and December, 1939, pg. 2), as well as for use as a diversion tunnel to carry the Sacramento River under the dam during its construction. The tunnel inlet elevation is 639, which is 398 feet below the spillway of the dam and 161 feet above the lowest portion of the foundation.

Since the tunnel was to be plugged and required to withstand great water pressure, the original rock excavation was carried on in such a way as to leave the solid ledge rock, through which it ran, heavily serrated around the entire circumference, and the concrete lining placed at that time was likewise designed to have its interior alternately tapered to a smaller diameter in the direction of flow, abruptly enlarged and again tapered, thus forming pressure-resisting anchorage for the concrete plugs to be installed later. The smaller cross section of the interior of the tunnel lining was horseshoe-shaped with a 16-foot bottom width, a width of 23 feet at 13 feet 4¾ inches above the floor, and a circular radius of 11 feet 6 inches forming the top. Just downstream from this minimum section, the size was abruptly increased to a bottom width of 21 feet, a width of 28 feet at a point 13 feet above the floor, with a 14-foot radius circle on top. This change in section occurred six times, providing for six plugs, each 27 feet in length. Plugging was started 718 feet from the upstream inlet of the tunnel and, in addition to the 162 feet of serrated plugs, a solid block of concrete 288 feet long was placed below them inside the tunnel bore to provide support for the foundation and dam above. The total overall length of the plug amounted to 450 linear feet.

Delivery of Concrete

Concrete for the tunnel plug was mixed in the central mixing plant used for all concreting at the dam site in proportions of 1:2.25:1.85:1.80, gravel being furnished in two sizes, No. 4 to ¾-inch and ¾ to 1½-inch. The cement content was 1.44 and the water-cement ratio by weight was 0.58. This design resulted in the production of a concrete with an average slump of 4½ inches and a maximum of 5½ inches. Concrete was delivered in 8-cubic-yard buckets to a point 200 feet from the location of the Pumpcrete machine by the elaborate overhead cableway system in use at the dam site (See C. & E. M. August, 1940, pg. 16). From that point it was transported to the Pumpcrete by a White dump truck with a 25-cubic-yard bed having a specially designed tapered section welded inside and discharging through a 24-inch sliding steel gate. This truck delivered the concrete to a 10-foot square metal hopper set above the Rex Pumpcrete machine and in which was a bottom rack formed of ¾ x 4-inch plates set vertically at 6-inch centers joined by 1-inch-diameter steel rods, to screen out oversize aggregate. Discharge from the hopper into the Pumpcrete was controlled by a swinging quadrant gate operated by an air ram.

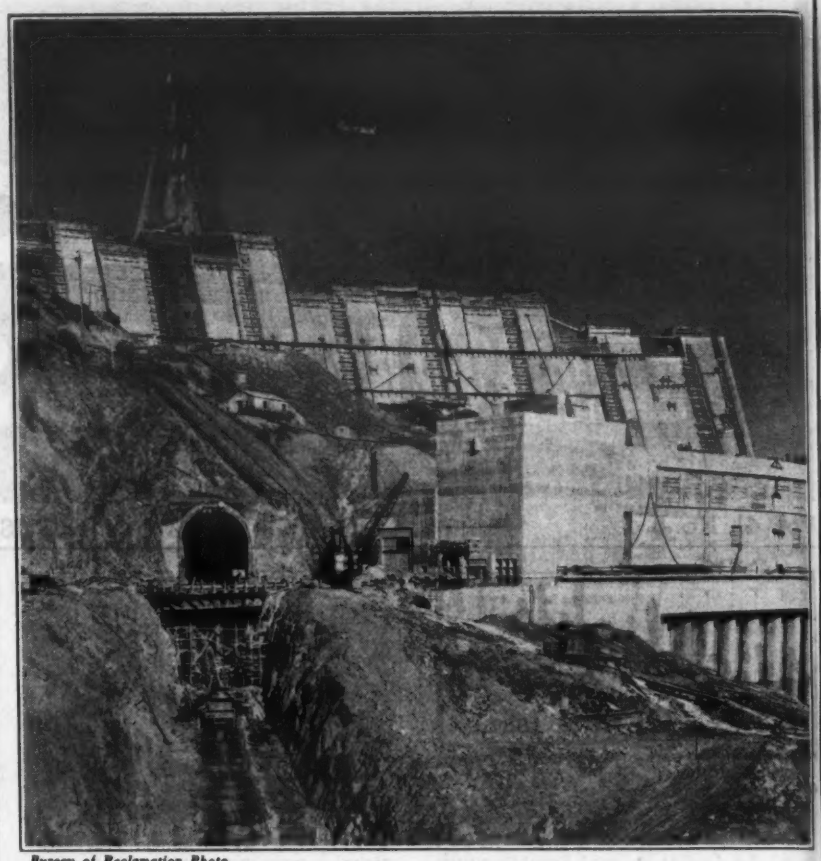
The twin cylinders of the No. 200 Rex Pumpcrete machine discharged through a Siamese connection into the 8-inch concrete line which had a maximum length of 1,137 feet and a vertical rise of 37 feet. Since each foot of vertical rise is the equivalent of 8 feet of horizontal distance, this set-up resulted in an equivalent length of 1,433 feet, which was excessive and resulted in some operational difficulties. A shortage of the regular 8-inch-diameter Pumpcrete pipe used in 10-foot sections for the major portion of the discharge line necessitated the use of approximately 500 feet of welded steel line of 8-inch diameter in its place. In this portion, 2-inch pipes were welded into the line at intervals of 250 feet through which compressed air could be introduced for cleaning the long sections by blowing a go-devil, made of a wad of burlap, through the line.

Ventilation during the work in the tunnel was provided by two Buffalo ventilating fans driven by 7.5-hp Westinghouse motors.

Forms and Concrete Placing

At the smallest point in each tapered section of tunnel lining, a bulkhead form was erected of 1 x 6-inch sheathing nailed horizontally to 2 x 6-inch vertical studs spaced 12 inches apart. Horizontal 4 x 6-inch wales were set 4½ feet apart and from these wales five 4 x 6-inch braces extended at an angle of approximately 45 degrees, with their bottom ends wedged against pieces of 4 x 6 timber laid on the floor at right angles to the center line of the tunnel and held in position by 2-inch-diameter pipe standing upright in holes previ-

(*Concluded on page* 12)



Bureau of Reclamation Photo
The railroad tunnel at Shasta Dam during preparation for its use as the river diversion tunnel during construction of the dam.

Highway Maintenance In Heavy-Traffic State

By WARREN K. MYERS, Chief Maintenance Engineer, Pennsylvania Department of Highways

Pennsylvania Carries On Its Wartime Maintenance With Own Forces; Salaries Replace Hourly Wages

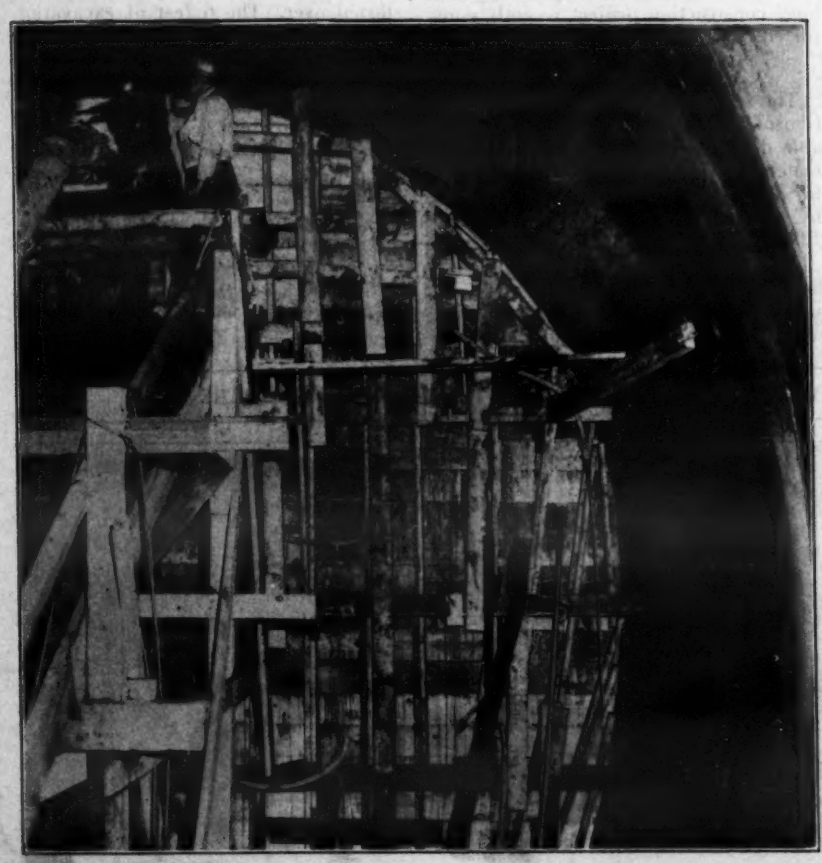
✦ WITH the restrictions placed on labor and materials, the induction of personnel into the armed services, and the increased traffic loads on the highways, the Pennsylvania Department of Highways has been called upon to use all of the ability, experience and ingenuity of its employees in order to maintain satisfactorily the 40,614 miles of highway comprising the state highway system in Pennsylvania. This system consists of 6,429 miles of concrete roads, 25,613 miles of bituminous roads, 870 miles of miscellaneous improved types of roads, 1,304 miles of stabilized roads, and 6,398 miles of unimproved roads.

Man-Power Shortage

The man-power situation in Pennsylvania has been critical since the outset of the war; in fact, this situation became critical in Pennsylvania before Pearl Harbor. Twenty-five per cent of all war materials produced in the United States has been produced in Pennsylvania and this activity alone employed all of the available man-power. In addition to this, 10 per cent of the men in the armed forces of the United States have been recruited or inducted from Pennsylvania.

The Department of Highways now has approximately 2,000 of its employees in the armed services, and at least 40 per cent of its regularly employed personnel, as of November 1, 1941, have left the Department to go into higher-paid jobs in war industries. This group of men consisted mostly of mechanics and supervisory employees. It was early appreciated that this Commonwealth could not compete with industry in the matter of wage rates and, as a result, the employees who remained with the Department and who have been employed since are older men. The personnel situation has been one of the most difficult problems confronting us in maintenance work.

(*Continued on page* 76)



Bureau of Reclamation Photo
Plugging the diversion tunnel at Shasta Dam. The well-braced bulkhead with the top section in place and concrete being delivered by the Pumpcrete line at the upper left corner.

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Eastern Field Editor Added to C&EM Staff

CONTRACTORS AND ENGINEERS MONTHLY is pleased to announce the appointment of William H. Quirk of New York City as Eastern Field Editor. Mr. Quirk, who is a graduate of New York University, has had a broad practical experience in the civil-engineering construction field, having served with the New York State Department of Public Works; the Ground and Buildings Department of the General Electric Co.; the Long Island State Park Commission during its program of park, parkway, bridge and causeway construction to provide new recreational facilities on Long Island; and with the New York City Park Department at the site of the World's Fair. More recently he has been in charge of the engineering work involved in improving the methods of recording real estate deeds for New York County. He is an Associate Member of the American Society of Civil Engineers.

William H. Quirk, new Eastern Field Editor for CONTRACTORS AND ENGINEERS MONTHLY.

Mr. Quirk, who will make his headquarters at our New York office, will spend most of his time covering the territory east of the Mississippi River, visiting construction projects and state and county highway department work, and his addition to the staff will make possible more thorough and intensive field coverage of the civil-engineering construction field, in order to continue to bring practical on-the-job articles to the readers of CONTRACTORS AND ENGINEERS MONTHLY.

Frank B. Sarles, who joined our staff last autumn as Western Field Editor, will continue to cover the western section of the country, with headquarters in San Francisco, and our Editor, Theodore Reed Kendall, will devote a larger portion of his time to editorial development, as well as to field work and contacts with contracting and engineering organizations throughout the country.

Sewage Effluent in Highway Ditches

Sporadic growths of housing facilities in what were pre-war rural areas have created several new highway problems. At the Willow Run Bomber Plant a duplex trailer settlement was so located that workers had to cross the Michigan Central railroad tracks to reach the plant entrance. This was corrected, removing a serious hazard, by the construction of an overhead pedestrian bridge across the tracks, a facility which has unfortunately been ignored by many of the workers for whose protection it was erected.

Another more widely spread and potentially dangerous condition has arisen in the vicinity of many war plants where newly constructed housing facilities are equipped with individual septic tanks for the "disposal" of household sewage. With no other drainage available, the effluents from many of these installations are running into and along the highway drainage ditches, creating nuisances and health hazards.

In at least one state, the very state health department whose duty it is to protect public health condones this method of final disposal of septic tank effluent and will do nothing to help the highway department to abate the nuisance. This same state health department has been pressing the largest city in the state for better sewage-treatment facilities and many of the small towns to build community plants and force all residents to connect to a common sanitary sewer. But it has done nothing to protect the health of these war workers and others living along the highway.

Septic-tank effluent is not clean effluent. The common septic tank, abandoned for all but strictly isolated residence and farm use many years ago, merely liquifies some of the solids of sewage, thus reducing the volume of solids that must be removed from the tank periodically, and reduces some types of bacteria, while others increase with the odor. The effluent must be treated with a sterilizing agent to insure its safety where it is disposed of by running into ditches or streams open to the public. Under the stress of war, however, some state health departments are closing their official eyes to the possibility of a serious epidemic.

Dr. Thomas B. McKneely, Chief of the Emergency Medical Section of the U. S. Public Health Service, reported recently that there are indications that tropical diseases might become prevalent in this country after the war and that their control will depend on the standard of sanitation maintained. Some of these tropical diseases are already present in this country, chiefly due to war casualties returning with the maladies, and Dr. McKneely pointed out that the threat will be greater when large numbers of men return from overseas after the war. This should be a warning to all state and county health departments to take every precaution now to be sure that no conditions exist which will further the spread of new diseases in this country. In concluding his address before the American College of Surgeons, Dr. McKneely said that people in rural areas are more likely to have an outbreak of these diseases because the level of sanitation control in rural areas is lower. It is in the rural areas that the conditions described above exist, so the health departments should be approached with firmness by the highway departments to prevent highway ditches becoming a menace to rural health.

That "public health is purchasable" is a well-known fact of long standing, which has been proved over and over. It is just as true in wartime, and with manpower shortages still threatening to slow down the production of munitions, our state health departments must take this burden from the state highway departments whose function is transportation and not public health.

SCENES ON THE SHIRLEY MEMORIAL HIGHWAY IN VIRGINIA

At right, a section of the completed dual-roadway Shirley Memorial Highway, showing temporary single-roadway construction in the distance, made necessary by war restrictions. Below, at left, grade-separation structures over a secondary road. Below, at right, a grade separation at a rotary intersection. Bottom photo, a rotary intersection with two grade-separation structures, on the Shirley Memorial Highway in Virginia.

Public Roads Administration Photos

22° BELOW ZERO

98° ABOVE

THE SEAMAN MIXER *Does the Impossible* IN AIRFIELD CONSTRUCTION

Above: Entire runway area consisted of large, solidly frozen marsh bogs.

Below: The finished runway after three days and nights of work with the SEAMAN.

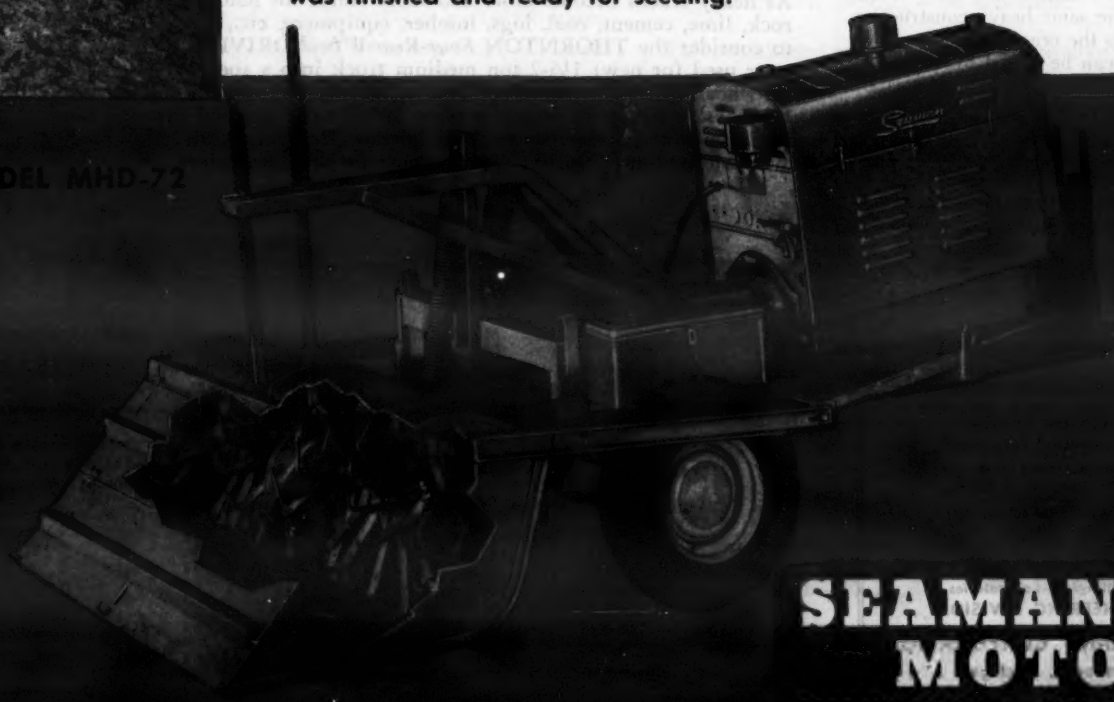
Below: In hot, baking 98° weather the SEAMAN MIXER pulverized sod to effect a runway leveling operation.

An intermediate runway had to be constructed at once to qualify an airfield (Waukesha, Wis.) for a Federal Pilot Training program. The contract would start in February. It was then the middle of January; — temperature 22° below zero and no relief in sight. The runway had to be built through a marsh literally peppered with bogs 12 to 18 inches in height — and the ground frozen so hard a pick axe would not penetrate.

Ten days were left when Seaman Motors was called into consultation. Hastily a new rotor for the SEAMAN PULVI-MIXER was designed, — modified of course for this extraordinary condition — and the machine put to work immediately, grinding and milling the rough, frozen ground to required level. Three days and three nights of cold, numbing work with the SEAMAN, — but on the morning of the fourth day, pilots landed their ships on the new runway . . . the only time in the history of flying a runway was constructed under such conditions.

98° ABOVE

A turf airfield had developed rough, jolting declivities and sharp ridges. Conventional tillage to break up the sod failed to reduce the clods sufficiently to prevent a lumpy surface after reseeding. Heavy rains had led to severe soil compaction and hot, dry weather following had baked the area as hard as a pavement. Again a call to Seaman Motors. The SEAMAN PULVI-MIXER in two passes completely pulverized the soil and at the same time filled in the low spots. In a few hours the area was finished and ready for seeding.



Yours for the asking, — the new 1944 Edition of "Soil Stabilization Methods" compiled by Seaman engineers. See for Buyers Guide 24.

SEAMAN MOTORS
MILWAUKEE, WISCONSIN

British Combine Photo
Bulldozing a section of the much-vaunted Atlantic Wall in Normandy into the sea. Most of the damage to this fishing port resulted from German flak ships in the harbor when the Royal Marine Commandos entered the town from the rear.

Adjustability Features Line of Snow Plows

A line of adjustable snow plows for use with crawler tractors, trucks or motor graders is made by the Wentz Equipment Co., 600 No. Van Buren St., Topeka, Kans., which reports that years of grilling tests on actual snow-removal jobs have demonstrated the performance of these plows. An 8-page folder describing and illustrating the Wentz line of snow plows may be secured by interested state, county and township highway engineers direct from the company.

Wentz adjustable V-type plows for use with crawler tractors are designed to fit the various makes and models of tractors by a simple length and width adjustment of the push-frame members. Other features include the skeleton-type steel frame construction, electrically welded, scientific curvature of the moldboard, and reinforced design at all points of strain. The skeleton-frame construction is designed to increase strength and at the same time eliminate clogging and packing of snow. The moldboard curve is designed to lift and discharge the snow easily. To give proper balance, Wentz V-plows ride on three adjustable steel shoes, equipped with removable runners. The entire plow assembly is always under the operator's control and can be lifted or lowered in any degree by the hand-operated hydraulic lift located at the driver's seat. The widths of cuts made by the plows in this series varies from 8 feet 7 inches to 12 feet, and wings 8 feet 6 inches and 9 feet 6 inches in length are also available.

Wentz adjustable motor-grader V-type plows can be furnished in sizes to fit the various makes and models of motor graders, both standard and wide tread, and are of the same heavy construction and design as the crawler-tractor plows. These plows can be raised by either hydraulic or mechanical power, or by hand hydraulic or mechanical power. The width of cuts provided is either 8 feet 6 inches, or 10 feet 2 inches.

The V-type truck plows are made in three models, with adjustable push frames to fit the various makes, models and sizes of motor trucks. With the scientifically curved moldboards and extra bracing strength, these plows are designed to give maximum snow removal with a minimum of power. The operator controls these plows by a hand hydraulic lift located in the truck cab.

Reversible plows for either tractor or truck mounting come in two sizes. The tractor models, like other Wentz models, are adjustable to fit different makes and models of tractors, and the truck plows are made in two models for 1½ to 5-ton trucks. They are easily attached and the moldboard may be set at different angles.

For snow-removal conditions requiring quick changes of blade angle for maximum efficiency, the manufacturer recommends the Wentz adjustable one-way plow, on which the moldboard can be changed at the operator's will. The arms are telescopic and adjustable to various angles. These plows come with adjustable shoes equipped with detachable saucer-shaped skid plates.

R. G. LeTourneau Names New Gen. Sales Manager

Announcement has been made of the appointment of Gordon S. McKenty as General Sales Manager for R. G. LeTourneau, Inc., Peoria, Ill., to succeed Ed R. Galvin who resigned to accept the presidency and a directorship of the Tyson Bearing Corp., Massillon, Ohio.

Mr. McKenty, a graduate of the University of Nebraska, served as an engineer for International Telephone & Telegraph in Mexico and China, the latter involving the task of rebuilding the entire Shanghai telephone exchange, and subsequently was in the construction equipment sales field in Nebraska for five years prior to joining LeTourneau in 1935 as a district sales representative in a number of middle-western and eastern states. From 1941 to 1943 he managed and expedited the $8,000,000 War Department shell contracts fulfilled by LeTourneau plants at Toccoa, Ga., and Vicksburg, Miss. In 1943, Mr. McKenty started a successful reorganization of LeTourneau's parts shipping, grown from a $25,000 monthly pre-war business to currently more than $1,000,000 monthly.

Completion of the R. G. LeTourneau, Inc., exclusive distributorship policy, already 70 per cent fulfilled, is among Mr. McKenty's first assignments as General Sales Manager.

New Bridge For Old Across Fla. Waterway

Old Wood Bridge Over Much-Publicized Coral Gables Waterway Is Replaced by Concrete Structure

✦ A concrete-bridge project which fills no major military need but which was given preferential ratings was recently completed in Dade County, Fla. The old wooden-pile structure across the famous wide ditch, 21 miles long, that provided the publicity man's claim of "42 miles of waterfront in Coral Gables", had been damaged by a barge, making it unsafe for vehicular traffic. As this crossing could not be closed and the construction left as a post-war project, replacement construction was permitted during 1943.

The new bridge is located at the same site on LeJeune Road, Coral Gables, south of Miami, Fla., and consists of a 64-foot central I-beam span and two concrete deck-girder approach spans of 33 feet each. The design does not provide for opening the bridge but will permit the reasonably easy installation of a bascule span if considered necessary after the war. The present spans give a 17-foot clearance, sufficient for the small fishing boats now using the waterway. There is also a small amount of commercial barge traffic moving rock, sand, and gravel.

Construction of Piers

The two abutments rest on solid rock on either bank, with two piers in the waterway. There are three columns supporting the structure at each pier and each is a separate unit with its footing. The footings are 10½ x 9 x 6 feet for the seal, which was placed by tremie with a 3-foot footing on top. Superimposed on this is a sub-column 9 feet high to the water line, topped by the column proper.

A cofferdam weighing about 12 tons was assembled on the shore adjacent to the work. It was built of 3½ x 8-inch tongue-and-groove lumber with four wales of 10 x 10-inch timber, the lowest wale being just above the seal. When completed, the cofferdam was placed in position by a floating crane, was then dredged out to –15, and the wood piles for the foundation driven to 8 to 17-foot penetration by a McKiernan-Terry 9B3 steam hammer. There were twelve piles for each of the side footings and nine in the center footing. They were cut off at –8½ just above the seal and extend 6 inches into the footings.

To unwater the cofferdam, the contractor used three pumps, a 6-inch Barnes centrifugal with a Buda motor for the heavy work, assisted by two 2-inch Rex Speed Prime pumps, one of which was used to keep the cofferdam dry during the remainder of the construction.

Form Work

For the footing and sub-column forms, the contractor used 1 x 6-inch tongue-and-groove lumber with 2 x 4-inch studs spaced 15 inches on centers and with tie rods. The forms for the columns and cross beams consisted of ¾-inch plywood with 2 x 4-inch studs on 18-inch centers and 4 x 4-inch wales. To carry the cross-beam forms, 6 x 6-inch posts were set up on the footings to support 6 x 6-inch stringers spanning the full distance between the columns. On these, at the ends, frames of 8 x 8-inch timber were set up to carry 4 x 8-inch lumber on edge to support the beam-bottom forms. The frames were tied with four 2 x 4's, on which rested a cross 4 x 4-inch piece with knee braces nailed to them for greater stability.

The contractor used but two carpenters on the site, as all of the forms and timber were cut in his shop, assembled as far as possible, and shipped to the job. The contractor is to be commended particularly for the heavy, well-built safe stairway giving access to the work from the bank on one side. It had a sturdy handrail so there was no excuse for accidents to workmen.

(*Concluded on page 25*)

C. & E. M. Photo

The LeJeune Road Bridge under construction across the Coral Gables Waterway, as seen from the north bank, showing the floating crane used to handle the forms. Powell Bros. of Fort Lauderdale, Fla., was the contractor.

North Carolina Plans Future Highway Work

Need for Reconstruction Of Present System Great; Sufficient Funds But Lack Design Engineers for Job

By W. VANCE BAISE, State Highway Engineer, North Carolina State Highway and Public Works Commission

✦ THE initial post-war construction for the improvement of the North Carolina state highway system will involve the relocation of certain obsolete sections of trunk-line highways where the alignment and sight distance make the existing roads dangerous, and will also include the widening of many narrow pavements and bridges, as well as the reconstruction of sections of roads that will be worn out as a result of age and the heavy war traffic moving over them.

It is impossible to determine at this time the amount of highway construction that will be done in the years immediately following the war. In the first place, no one can determine the amount of damage the existing road system will sustain as a result of heavy concentrated war traffic, and also as a result of insufficient maintenance of the highways while they are subjected to such severe tests. The amount of automobile traffic in the state has been materially reduced since the rationing of tires and gasoline; on the other hand, the number of trucks has increased slightly and the total loads moved by these trucks have materially increased over those moved before the war. These severe loads are being placed on the trunk-line highway system at a time when the pavements have been down from 16 to 23 years and are, therefore, more fatigued and less able to endure the strain than at any time in the past.

Due to the difficulty in securing manpower, materials and equipment, and the increased cost of all of these items, it is estimated that we are getting about 35 per cent as much effective maintenance as we previously secured. The Commission is actually spending approximately two-thirds as much money for maintenance at this time as before the war, and in view of the amount of shrinkage of the highway dollar in what it will purchase in maintenance work, as well as the great amount of lost motion due to the difficulty of obtaining materials, equipment, repair parts, and very often in securing sufficient labor to carry on the work, the effectiveness of maintenance has actually been reduced the amount mentioned above. This condition necessitates that we concentrate our forces and equipment on the most essential and routine work rather than on such work as would tend to keep the condition of the roads as good as they were in previous years.

Post-War Construction

A very large part of the construction after the war will involve reconstruction and relocation of existing trunk-line highways, and some of it will include portions of the tentative Interregional System as recommended in the reports submitted to Congress some time ago. Since North Carolina does not have any large cities, the largest being slightly more than 100,000 in population, it is not believed that there is sufficient traffic in any of the cities to justify the construction of expressways through such communities. There is, however, a very great need for widening some of the through streets and for providing means of parking traffic off the main highways. There is also a great need for better control of traffic and enforcement of the ordinances for such control in connection with parking along trunk-line highways through the cities and towns. This would increase the effective width of the highway and materially facilitate the movement of traffic through the urban areas.

The total estimated cost to bring the North Carolina highway system up to the necessary requirements for safe travel after the war is estimated at approximately $175,370,000, which is divided as follows:

Type of Work	Mileage	Estimated Cost
Widening, rebuilding and resurfacing of urban highways	190	$22,800,000
Rebuilding rural state highways	400	18,000,000
Relocation and rebuilding of rural state highways	1,045	41,820,000
Widening state highways	1,250	18,750,000
Widening or rebuilding bridges	795 (no.)	20,000,000
Rebuilding secondary and feeder roads	3,600	54,000,000

Of this program, it is believed that not more than $75,000,000 can be taken care of during the first three post-war years unless engineering personnel becomes much more plentiful than at this time appears probable and thereby permits the building up of a sufficient organization to plan and supervise such a program.

Man-Power Situation

Since 1941, this Commission has lost approximately 75 per cent of its engineers in the Drafting and Design Departments, and approximately 50 per cent of those in field survey work. In the Right-of-Way Department, the loss has been less severe, being only about 30 per cent of the total personnel. A large number of the engineers who have left the Design and Location Department have entered the armed services and will probably not return at least until some time after the war is over. Many of the others who have left for the much better salaries paid in war industries will probably not return at all, inasmuch as it is expected that there will be a very large amount of construction of various kinds, not only in this nation but in reconstructing the war-damaged nations, as well as developments in South America and elsewhere, which will appeal to them more. We have succeeded in hiring a few girls for work in the drafting rooms, but in practically all cases they have been inexperienced and have had very little previous training. Every possible effort has

(*Concluded on page 27*)

Chairman of the Board Of Cleveland Tool Dies

Daniel C. Green, Chairman of the Board and chief executive officer of the Cleveland Pneumatic Tool Co. and its wholly-owned subsidiary, Cleveland Pneumatic Aerol, Inc., died last month at Petoskey, Mich., after a seven weeks' illness.

Mr. Green was a nationally known financier and consultant in the operation of public utility properties and was made Chairman of the Board of Cleveland Pneumatic at the request of the War Production Board shortly after the death of L. W. Greve. His service with Cleveland Pneumatic dates from March 25, 1942, when he accepted the position purely as a war assignment and with the understanding that he would return to the professional consulting field as soon as his work with the tool company was completed. He was named company president in June, 1943, when John De Mooy resigned, later gave up the presidency to George P. Torrence, and became Chairman of the Board.

Richmond Appointments

Coincident with plans for post-war expansion by the Richmond Screw Anchor Co., Brooklyn, N. Y., manufacturer of form ties, clamps and other devices for concrete construction, Charles A. Snyder, President, has announced the appointments of Robert E. Mitchell as General Manager, and of Clifford W. Chapman as Treasurer.

Mr. Mitchell was associated with the Joseph Dixon Crucible Co. for twelve years as Division Sales Manager, and in 1940 he founded and became president of Paint Engineers. Mr. Chapman is a CPA, formerly associated with Haskins & Sells and subsequently with Gould McIntosh & Co.

U. S. Engineers Photo
The Engineer Corps' new beach tractor, recently shown to the public for the first time.

Army Engineers Show New Beach Tractor

Modern warfare is highly mechanized and highly mobile, and has placed the greatest demands in history on Army Engineers and on Engineer equipment. Among the Engineer weapons of war which were demonstrated by the Corps of Engineers at the Army Service Forces recent show held in Central Park, New York City, was the beach tractor.

Shown to the public for the first time, this unit consists of a crawler tractor, a bulldozer, a self-mounted crane, a double-action power-control unit, and an armored cab for the protection of the operator. This is the first piece of heavy equipment landed in any amphibious operation and, it is said, can do the work of 500 men in unloading and handling other equipment. Weighing more than 21 tons, the beach tractor can lift and carry a deadweight load of 7 tons, and the crane is particularly useful in unloading landing craft, or in lifting out of heavy sand cargo trucks, field artillery pieces, or anything else that gets stuck. When a construction job is to be done, the versatile bulldozer goes to work, and the variety of services it is performing on all the fighting fronts has made it one of the "heroes" of the war.

Another important piece of equipment is the airborne tractor-bulldozer outfit, shown being lifted by the crane. The work of the Airborne Engineers and their equipment have been invaluable in creating landing strips and air bases in a few days.

Haiss Bucket Loaders Described in New Catalog

Highway engineers and contractors will be interested in a new 23-page catalog and supplementary 12-page booklet issued by the George Haiss Mfg. Co., Inc., Canal Place and E. 142nd St., New York 51, N. Y., describing and illustrating four models of bucket loaders, both wheel-mounted and with crawler treads, for excavating, stripping, rehandling and loading earth, sand, gravel and similar material. General specifications and detailed descriptions are given, as well as illustrations of the various models and on-the-job pictures of the loaders at work.

A particularly versatile model in this line is the Model 75, with a rated capacity of from 2½ to 3 cubic yards, the chassis of which is designed for interchangeability of wheels and crawlers in the field, without drilling, cutting or welding. This model can also be converted to a snow loader, capable of delivering from 7 to 12 yards a minute. Other models are the 77, with wheels or crawlers, of 3-yard capacity, and equipped with a higher elevator to load high-sided trucks; and Models 80 and 135 of 5 and 8-yard capacity respectively. Additional equipment described includes portable and self-propelling belt conveyors, and power, clamshell, sheave and power wheel buckets.

Copies of this literature are available upon application to the manufacturer. Just mention this item.

No Breakdowns Allowed At Great Lakes, Illinois

U. S. Naval Training Station Has Large Automotive Pool Stored and Overhauled at Main and Camp Garages

(*Photo on page* 88)

✦ A fleet of 675 trucks, passenger cars, motorcycles, graders, tractors, mowers and other miscellaneous automotive equipment is maintained to serve the community of 80,000 population that is the U. S. Naval Training Station at Great Lakes, Ill. To keep this great fleet in prime condition for service day and night, week in and week out, a system of garages is operated by the Transportation Officer under the direction of the Public Works Officer of the Station. The main garage is responsible for all major overhauls and for all work on about one-half of the fleet of equipment, while the three maintenance garages distributed through the various camps within the Station each has its own small fleet to maintain and dispatch.

A feature of the system of maintenance is that the maintenance garages have a minimum of tools for the overhaul of trucks, and when a special piece of work is required, not involving the use of the heaviest machine tools, the portable tools are sent from the main garage to the maintenance garage for the time required for the work. This system reduces by at least one half the number of special tools required to be in stock in the Station and is recommended to civilian garage systems in the states and counties where duplication of certain special tools can thus be avoided.

Typical Maintenance Garage

The maintenance garage at Camp Porter was selected as typical and is hence described in some detail. It has one special feature, namely that, in addition to its own fleet of trucks, it maintains and stores the twenty-one jeeps used by the Security Patrol. A total of twenty-six trucks are stored at the Camp Porter Garage, including two Ships Service trucks which supply the canteens, three ambulances, and one trash truck. The remainder of the truck fleet consists of stake, pick-up, panel, and dump-body units.

This typical maintenance garage is a wood structure 60 x 150 feet with wood trusses supporting the built-up wood roof. The top chords of the arched trusses are laminated for strength. The garage complement consists of a civilian "snapper" or "straw boss" mechanic, a Master at Arms who is an enlisted Navy man, with seven sailors, one civilian mechanic, six recruit (boot) drivers, one civilian driver for the trash truck, and about two civilian laborers as needed.

At this garage all maintenance work, except heavy overhaul, is done on the twenty-six trucks and the twenty-one jeeps assigned to the garage. The general equipment consists of four Bowser oil dispensers, two drums of alcohol for anti-freeze mounted on a frame for convenience in drawing off into dispensers, and a shop section set apart by an 8-foot wall of tile with a gate wide enough to admit any truck.

In the shop section is a long metal-top bench with vises for the use of the mechanics and drawers underneath where they may lock up their heavier tools when not in use. The locks are a novel but effective device consisting of a small pipe passing through two U-bolts from the inside of the drawer and with a padlock at the end of the pipe to prevent its removal. The carpenter shop built a small compartment box which is easily slid along the bench to hold the various sizes of bolts required for the work. Other equipment includes a Baldor bench grinder, an AC spark-plug cleaner, a Silver Beauty stationary battery charger, a floor-model portable Allen fast charger, a pneumatic-power

(*Continued on page* 66)

The shop section of the Camp Porter maintenance garage.

Concrete Tunnel Plug Placed in Shasta Dam

(*Continued from page 2*)

ously drilled in the concrete floor. Before placing of concrete was begun, the bulkhead form was completed to a point 20 feet above the floor, the limit of the first lift of concrete. The original concrete lining was thoroughly cleaned by wet sand blasting, before concreting was started.

The Pumpcrete line carrying the incoming concrete lay on the floor of the tunnel until it reached a point approximately 40 feet in front of the bulkhead. At this point it was turned upward and supported on a slope by a framework of 10-inch-diameter timber poles extending to the bulkhead at an elevation just above the top of the 20-foot-high forms. From that point the line again resumed a horizontal direction and was supported by two 10-inch-diameter timber poles extending from the end of the sloping timber ramp to two recesses, 18 inches square and 18 inches deep, which had been left 5 feet each side of the center line and 20 feet above the floor in the plug section previously poured. The concrete was discharged into hoppers supported by the same poles and dropped through elephant-trunk chutes into final position.

To place the concrete in the second lift, which made the top 5-foot closure, the section of the regular Pumpcrete line inside the forms was replaced with a 24-foot-long section of Spiralweld steel pipe placed against the ceiling and extending to the apex of the plug section. This section of line was held in place by pieces of pipe embedded in the first lift and remained embedded in this lift. The forms were built up to the ceiling and were held in place by tie rods extending from the wales to anchors drilled and grouted into the ceiling concrete. The second lift was placed one to five days after the first lift.

The time required to place each section of the tunnel plug, which contained approximately 545 cubic yards of concrete, varied from 15 hours to a maximum of 24 hours for one pour when only one cylinder of the Pumpcrete machine was operating. Under good operating conditions, the Pumpcrete averaged about 40 cubic yards an hour.

Cooling and Grouting

During the concreting, longitudinal lines of 1-inch-diameter pipe for cooling water were placed at 5-foot intervals, both horizontally and vertically, for the entire length of the concrete plugs and connected to the pumping system which delivered river water through them for a period long enough to reduce the temperature of the concrete to within 5 degrees of the cooling water. This operation required from six to eight weeks.

For later grouting after the concrete had contracted, ½-inch lines of pipe, which had been installed at 20-foot intervals in the original tunnel lining, with outlets each 10 feet on their circumferences, were fed from a 1½-inch header line placed in the bottom. Half way between the encircling grout lines were ½-inch air-escape lines of similar construction, each discharging through a separate connection so that completeness of grouting operations could be checked by the discharge of grout through the air lines. For grouting, a 1 to 1 mixture of cement and water was pumped through the lines by a Gardner-Denver grout pump.

Personnel

The pouring of the diversion-tunnel plug was not a separate contract but was incidental to the contract for the construction of Shasta Dam, awarded to Pacific Constructors, Inc., for whom Frank T. Crowe is General Superintendent, Frank Bryant, Field Superintendent, and W. V. Greeley is Chief Engineer. For the Bureau of Reclamation the work is under the supervision of Ralph Lowry, Construction Engineer, Kennett Division, assisted by J. P. Granger, Chief Inspector, C. S. Rippon, Chief Inspector of Concrete Structures, and a corps of assistant inspectors.

Report on Conference Of Highway Association

Proceedings of the Twentieth Annual Meeting of the Association of Highway Officials of the North Atlantic States, which this year was primarily a conference on post-war plans and related problems, held in New York City February 17 and 18, are reported in a paper-bound 122-page booklet just issued by the Association from the office of its Secretary, State House Annex, Trenton, N. J.

The entire program is fully reported, including the papers presented at the various sessions. Within the framework of post-war planning, the subjects covered varied widely, comprising a discussion on highway construction by Charles M. Upham, Engineer-Director of the American Road Builders' Association, the future of aviation by L. Welch Pogue, Chairman of the Civil Aeronautics Board, and a résumé of the British plan for dealing with public works now and in the era following the war. The discussions which followed each paper have also been reported, as well as the resolutions adopted at the conclusion of the meeting, looking to the most satisfactory and equitable settlement of our post-war problems and adequate plans for the future.

Emergency Shear Plates Prevent Roll Breakage

Recently devised emergency shear plates, quickly replaceable, have been announced by the Iowa Mfg. Co., Cedar Rapids, Iowa, as a safety improvement against roll breakage on aggregate crushers. Under ideal working conditions, heavy helical springs of chrome vanadium steel maintain proper tension on the floating roll and keep the opening for material constant; yet when uncrushable foreign material is introduced, the springs protect the roll by relieving the undue stress and prevent breakage.

If exceptionally large uncrushable material passes into the rolls, shear plates at the butt of the springs snap and free the springs completely. Each shear plate consists of 11-gage sheet iron, and is located in the slot of the adjustable plate that holds the spring in position. Any large piece of uncrushable material, such as tramp iron, would cause the nut, slotted for and holding the shear plate, on the end of the adjustable screw bolt, to shear the plate and allow the unrestrained bolt to pass through the spring and instantly release all tension on the floating roll.

To resume operation, it is necessary only to replace the shear plates. Extra plates are furnished with each crusher.

Road Repair Crews A Traffic Hazard

Although the decrease in volume and speed of traffic has resulted in a corresponding reduction in exposure to traffic accidents and in the degree of violence of such accidents, changed highway conditions present a new hazard in the frequency and nature of present highway maintenance, according to an article in a recent issue of the *Highway Bulletin*, issued by the Illinois Division of Highways. The average motorist, the article states, undoubtedly feels safer driving now than he did in 1941, but the increased number of men doing repair work on the highways this summer requires renewed vigilance on the part of both driver and workmen to prevent serious accidents.

There are two reasons for this situation. First, heavy truck traffic necessary for hauling essential war goods has more than offset the decreased civilian traffic and has done more damage to road surfaces than would ordinarily be inflicted by peacetime traffic. Second, restrictions on new construction have prevented replacement of worn slabs or construction of new lanes to relieve overcrowded or worn roadways, making it necessary to repair and resurface old pavements. To illustrate this point, it is reported that, in 1943, 1,952 miles of pavement in Illinois were patched, equalling 62 miles of new concrete pavement. In addition, 172 miles of pavement were repaired by the application of asphalt resurfacing over the old pavement. This same condition applies in more or less degree in other states.

There is greater traffic hazard in highway maintenance than in new construction, since the former is done under full or partial traffic, and it is important that both workers and motorists understand the conditions involved. Particularly in concrete patching or in filling cracks with bituminous material, where the men must work with their heads down, or where heating tanks, trucks and other equipment obscure their vision, watchfulness is essential.

Accident statistics in Illinois show that during the past three years six state highway maintenance employees died as a result of being struck by motor vehicles while they were doing repair work; thirty-five were hospitalized with serious injuries; and one hundred and twenty-two received less serious injuries. In addition to the suffering and hardship to the individuals, these accidents cost the state more than $50,000 and 5,562 man-days of labor were lost.

Signs, barricades, flares and flagmen are the commonly used traffic controls where road repair work is in progress and, with the increase in this type of operations this summer, it is very likely that many and various combinations of these warnings are encountered on the highways. It is very essential that these signs and warnings make clear to the motorist the nature of the work going on and the precautions he is expected to take, both for his own safety and that of the men engaged in the vitally important work of keeping the highways in good condition.

New 10-Year Program To Develop Airports

Jennings Randolph Introduces H. R. 5024 To Institute a $2.000.000.000 National Airport Program

✦ ON June 14, Representative Jennings Randolph of West Virginia introduced a Federal-Aid Airport Bill, H. R. 5024, calling for the expenditure of $1,000,000,000 in Federal funds for airport development. The administration of the bill would be under a newly created Director of Airport Service under the Civil Aeronautics Administration.

Following the general plan of Federal Aid for highway construction, the bill requires the establishment of "state airport agencies" and all funds would be apportioned among the states under a legislative formula. The formula included in the bill provides that funds will be apportioned among the states in the proportion which their population, area, and number of registered civil aircraft, other than those owned by scheduled air carriers, per civil airport bear to the total population, area, and number of civil aircraft of all the states per civil airport.

In order to bring about the establishment of a nation-wide system of public airports adequate to meet the present and future needs of civil aeronautics, the bill directs preparation of a national airport plan and authorizes the appropriation of $100,000,000 for the fiscal year ending June 30, 1945, and $100,000,000 for each of the nine successive fiscal years. States will be required to match Federal contributions on a 50-50 basis, thus making a total program of $2,000,000,000. Special provision is made that not more than 2 per cent of any annual appropriation can be expended for the development of any one airport.

To be eligible for participation in Federal airport aid, the states must meet the following requirements: (1) Enact appropriate enabling legislation; (2) Set up a state airport agency with adequate powers and suitably equipped to fit the requirements of the Federal-Aid airport program; (3) Enact legislation for the prevention and removal of airport hazards; (4) Refrain from taxing aircraft fuel or aeronautical facilities and operations unless the proceeds are devoted entirely to the development of civil aeronautics; (5) Take adequate steps to assure proper management and maintenance of all public airports; and (6) Take adequate steps to assure the availability of state funds for participation in the Federal-Aid airport program.

The Administrator of the Civil Aeronautics Administration is directed to prepare and keep current a national plan for the development of public airports adequate to meet the needs of civil aviation and the national defense. In formulating the plan, the Administrator is required to take into consideration the views and recommendations of the several states and their political subdivisions. When developed, the plan will specify the general location and type of airports and set up appropriate priorities for construction.

Van Way Joins Dealer

John F. Van Way, formerly Western Advertising Manager of *Pit & Quarry*, has joined the Clearview Equipment & Mfg. Co., equipment distributor located at 1320 So. Grand Blvd., St. Louis, Mo., as sales representative. Prior to joining *Pit & Quarry*, Mr. Van Way was associated with the George A. Fuller Co. as Concrete Plants Superintendent, and also served as Advertising and Sales Promotion Manager of the C. S. Johnson Co., Champaign, Ill.

Acme Photo By Charles Seawood, War Pool Photographer

Bursting forth in its most violent eruption in years, Mt. Vesuvius covered Italian roads with ashes, seriously blocking traffic. Here a Caterpillar tractor and LeTourneau bulldozer clear away the ashes to permit passage of Army vehicles.

New Additions to Line Of Concrete Vibrators

The most complete line of vibrator equipment in its history has just been announced by the Master Vibrator Co., 100 Davis Ave., Dayton 1, Ohio. In making this announcement, the company points out that the new improved metal-to-metal welded flexible drive, now used on all Master vibrators, has proved that a flexible shaft casing can be flexible enough to be handled easily and at the same time be tough enough so that it cannot collapse, shrink or stretch. The metal ferrule on each end of the casing is welded to especially designed inner liner that requires no inner support. The fabric and rubber covering that goes over the inner lining and into the end ferrule acts only to keep the dirt out and the lubrication in.

The latest addition to the Master line is the Master vibratory concrete finishing screed. This is a self-contained unit, powered by a 1½ or 3-hp gasoline engine, and is available in lengths of 6, 10, 13, 16, 20, 25 and 26 feet. Standard machines produce a flat slab, but units for producing any crown or invert can be obtained on special order. These screeds have a capacity up to 6,000 square feet an hour.

The complete line of vibrators manufactured by Master consists of electric-driven units of ½, 1½ and 3 hp, and 1½, 3 and 4-hp gasoline-engine-driven units for light, medium, and heavy-duty work.

For detailed information on these vibrators, Bulletins No. 528 and 596 may be secured direct from the Department of Information, Master Vibrator Co., 100 Davis Ave., Dayton 1, Ohio. Just mention this item.

Portable Road Roller For Highway Maintenance

A 4-page folder describing the completely portable Ferguson Model 151 road roller for highway maintenance and patching jobs is available from the Shovel Supply Co., P. O. Box 1369, Dallas 1, Texas. Due to its ready portability, this roller is particularly suited to use by state, county, and town highway departments and the various departments of the Federal government, where the work is widely scattered.

Providing a pressure on the large roll of 180 pounds per linear inch, the Ferguson roller weighs 5,150 pounds, has a 32-inch-diameter roll, and is powered by a 6 to 8-hp air-cooled gasoline engine. The Model 151 is operated exactly like the conventional tandem roller, and is equipped with a 15-gallon tank which supplies water for keeping cocoa mats on both rollers wet. Automatic self-adjusting scrapers prevent materials from sticking to the rolls, and powerful brakes give the operator complete control on grades up to 20 per cent. When a job is finished, the pneumatic-tired transportation wheels are lowered, a tongue inserted, and the roller is ready for trailing at high speed behind a truck.

Copies of this Bulletin 1550 on the Ferguson maintenance roller may be secured direct from the manufacturer. Just mention this item.

Asphalt Official Dies

Karl E. Kneiss, Manager of the Asphalt and Road Oil Sales Department of the Tide Water Associated Oil Co., died on June 13 at the age of 72. Mr. Kneiss, who was a native of Cincinnati, Ohio, had been associated with the Tide Water organization since 1907. For the past thirteen years he has been a Director of The Asphalt Institute, and was Treasurer of the Institute's Pacific Coast Division.

Mulch-Seeding Job For Maryland Route

Roadside Development Activities Now Limited To Control of Erosion; Post-War Plans

By S. W. BAUMILLER, Landscape Engineer, Maryland State Roads Commission

MARYLAND'S Roadside Development Department is just emerging from its demonstration stage. Because of the success of its erosion-control work, the Department has won the confidence and approval of the Administrative and Engineering Departments, as well as the entire maintenance personnel. For our beginning and existence through infancy and the demonstration period, credit goes to our civic organizations, especially the Federated Garden Clubs, because our erosion-control activities really resulted from their requests for assistance in planting trees and shrubs. Now erosion control is considered the Roadside Development Department's most important activity and has become an integral part of our highway construction. Mulch-seeding and sodding, where necessary to establish quick and immediate ground cover on steep grades and in surface-water run-off channels, have been included in most of Maryland's original road-construction contracts or have been done separately immediately after the highway was completed.

A 1944 Project

Besides the routine work on small and repair jobs of tree and shrub planting and mulch seeding being done by Department forces, late in April a contract was let for the mulch-seeding of approximately 300,000 square yards of roadside slopes on a section of Three-Notch Road in southern Maryland. This section, which has just been widened, is 18 miles long and its roadside areas comprise about 90 per cent cuts and fills. The work was completed on June 1.

All areas which had become eroded were restored to the original cross section, for which the contractor was paid 25 cents per square yard. About 10 per cent of the slope areas required such restoration. Then the soil of the entire area was loosened horizontally by disks and harrows, and 4-12-4 fertilizer applied at the rate of 40 pounds per 1,000 square feet.

Grass seed, consisting of 20 per cent sheep's fescue, 20 per cent orchard grass, 15 per cent red top, 15 per cent Korean Lespedeza, 15 per cent hairy vetch and 15 per cent domestic rye, a mixture designed for a variety of subsoils ranging from sandy to about 50 per cent clay and for use in surroundings of natural growths of sheep's fescue and Lespedeza, was applied at the rate of 2½ to 3 pounds per 1,000 square feet. The seeded areas were then harrowed lightly, either with a spike-tooth harrow or by hand rakes, after which mulch was placed immediately at a depth, when loose, of not less than 1½ inches and not more than 3 inches. This mulch, which was wheat or oat straw, or hay or run of the fields unfit for feeding purposes and containing no harmful weeds or material larger than ¼ inch in diameter, was secured in place by pressing it into the soil either by a harrow with its disks set perpendicular or by punching it into the soil at 5-foot intervals with hand shovels.

This 300,000-square-yard mulch-seeding project required approximately 54 tons of fertilizer, 4 tons of grass seed, and about 140 tons of mulch. Several dump trucks, a small power shovel, tractors, harrows, seeders, fertilizer spreaders, and small tools were included in the equipment used. The number of men needed to complete the project in the 35 days allowed varied between thirty and forty, depending upon their experience and efficiency. The cost of this mulch seeding complete was 8½ cents per square yard.

Left, the effect of roadside erosion on guard rail. Above, a windrow of sod placed at the guard rail on a Maryland highway to intercept water and permit run-off at designated intervals over sodded flumes.

Wartime Curtailment

Before the war, the Maryland Roadside Development Department was going full speed, planting trees and shrubbery as well as establishing vegetative ground cover for erosion control through the use of low shrubs, vines, mulch-seed-

(Continued on page 34)

Wall Chart Aids Repair Of I-R Chipping Hammers

The publication of a wall chart, 22 x 38 inches, entitled "Easy Repair Operations for I-R Flapper Valve Chippers", has just been announced by the Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y., to aid in the servicing of this widely used chipping hammer. This metal-bound two-color chart is graphically illustrated with an "exploded view" of the hammer, a cross-section view, a number of cross sections of the various parts, and drawings of the few simple tools required for proper maintenance, such as reamers, lappers and gages. Also illustrated are the various recommended maintenance operations. These are accompanied by clear captions which tell when and why they are recommended for the efficiency and longevity of the hammer. Clearances and settings are expressed in steel rule and micrometer values.

The chart also shows stock sizes of oversize replacement parts and how to determine which to order, the proper methods of lapping, reaming, and rebushing, and instructions for proper lubrication and cleaning.

Copies of this chart, Form 5634, may be secured by those interested direct from the main office of the Ingersoll Rand Co. or from any of its branch offices throughout the country.

Cotton Face Protector For Line of Respirators

A new feature of its R-1000 respirator, in the form of a knitted cotton facelet which fits around the edge of the respirator and acts as a buffer to prevent skin irritation and chapping, and also offers a certain amount of protection against dust and dirt, is announced by the American Optical Co., Southbridge, Mass., maker of safety clothing, protective goggles, helmets, respirators and similar safety devices for industrial workers.

The facelet, the manufacturer states, eliminates the need for using protective creams to avoid face chapping, absorbs perspiration, is soft against the skin, and is designed to make industrial operation more comfortable, particularly for workmen handling cement, lime, gypsum, or engaged in paint spraying. In addition to being standard equipment on AO respirators, the new facelets, which can be washed for re-use, may be ordered separately, packed fifty in a box.

Concrete-Pipe Sewer Contract, Bridgeport

A 2,600-Foot Section Laid By V. Barletta Co. in Glacial Drift; Part of Extensive Program in Conn. City

(Photo on page 88)

✦ AS part of its $3,300,000 wartime sewer and sewage-treatment plant program to protect the health of its industrial and domestic population, the City of Bridgeport, Conn., has awarded twelve major contracts, with eight more to come. (See C. & E. M., July, 1944, pg. 21). The contracts for the trunk and sanitary sewers were awarded on the basis of the city furnishing the concrete pipe, and the contractors' unit price per foot was for installing that pipe in a trench with the underdrain, cradle and trench sheeting as required.

A contract was awarded to V. Barletta Co., of Roslindale, Mass., for $212,375 for the installation of 2,600 feet of 54-inch reinforced-concrete pipe, with shorter lengths of 48 to 27-inch reinforced-concrete pipe and 18 to 8-inch vitrified-clay pipe connections. Contract No. 9, the Barletta contract, ran from Union Square south on Water Street, then west on South Avenue, and south again on Main Street to Railroad Avenue.

The trench in this section averages 18 feet deep, with a maximum of 20 feet, in well-stratified glacial gravel and sand with a stiff clay at the bottom of the trench. The excavation was made 10 feet wide with vertical faces without sheeting for the first 6 feet, after which this contractor drove random-width 3-inch tongue-and-groove sheeting as the excavation progressed. Lumber from 8 to 12 inches wide and 20 feet long was used. Four wales of 8 x 8-inch timber with 8 x 8-inch braces at 10-foot intervals provided a safe and tight sheeting. Rangers of 6 x 6-inch timber were used on the outside to aid in maintaining the very good line of sheeting. Driving was done by a 3-inch Ingersoll-Rand sheeting hammer with air from a Chicago-Pneumatic 315-cfm portable compressor.

Excavation

Excavation ahead of sheeting was handled by a Lorain backhoe with a ½-yard dipper. After one very wet spell, a Lorain crane with a ¾-yard Owen clamshell aided in the clean-up. At the junction of Main Street and Railroad Avenue, where extra bracing was required, and the sheeting left in place because the viaduct of the New York, New Haven & Hartford Railroad is only 30 feet distant, a Byers crane with a ⅓-yard tip bucket was hand-loaded.

As the work was in streets with many wires on poles at the curb, the crane booms were boarded for insulation. Careful operation resulted in no damage to wires, but the contractor, being safety-minded, took all precautions. A safety engineer of the bonding company visited the job regularly to aid the contractor.

A fleet of eight to ten Mack and White trucks with Gar Wood bodies and hydraulic hoists hauled practically all excavation to backfill. The hauls were sometimes as much as a mile because of traffic conditions, although the backfill and excavation were only a few hundred feet apart. Backfill was dumped beside the trench and placed by a clamshell to a height of 4 feet over the pipe, then puddled with water purchased by meter from the Bridgeport Hydraulic Co. The top of the backfill was leveled by a Caterpillar RD7 tractor with a LaPlant-Choate bulldozer.

The character of the ground, a coarse gravel over an impervious clay in the bottom of the trench, led to inflow of water all along the trench, but no heavy flows. This water was removed by three Jaeger Sure-Prime centrifugal pumps set on a platform across the sheeting braces. A 6-inch and two 4-inch pumps were used.

Pipe Laying

Ahead of pipe laying, the contractor placed an 8-inch layer of gravel as an underdrain and poured a 6 to 12-inch concrete cradle, using truck-mixed concrete chuted into the trench and puddled and struck off by hand. The pipe, weighing a maximum of 4,340 pounds per length, was swung direct from the cradles on the flat-bed hauling trucks to the concrete cradle in the trench by the Lorain crane, using a pipe hook.

Heavily braced sheeting in the sewer trench for 54-inch pipe on Railroad Avenue, adjacent to the N. Y., N. H. & H. RR viaduct, in Bridgeport, Conn.

Personnel

Contract 9 for Section 1 of the Water Street trunk sewer in Bridgeport, Conn., was awarded to V. Barletta Co., of Roslindale, Mass., for $212,375. The job was operated personally by V. Barletta. For the City of Bridgeport the work was in charge of Henry L. Rowland, City Engineer. C. R. Chisholm was Construction Engineer for the Federal Works Agency, representing the Sub-Regional Office in Boston.

Marion Directors Name Chairman and President

At a meeting of the Board of Directors of The Marion Steam Shovel Co., Marion, Ohio, J. M. Strelitz was elected Chairman of the Board, and C. F. LaMarche was elected President and General Manager to succeed the late D. J. Shelton. Mr. Strelitz has been a Director since 1931, and has acted as general counsel for the company for the past twenty years. Mr. LaMarche has served as a Director since 1939.

The Wage-Hour Act And Post-War Work

Construction Industry Is Defined Very Broadly Under Latest Wage Order Which Covers 1,500,000 Workers

By ROBERT C. WASHBURN, Wage and Hour Division, U. S. Department of Labor

✦ ON July 17, 1944, the final two wage orders under the Fair Labor Standards Act became effective and a 40-cent minimum hourly wage will have been set for more than 21,000,000 American workers, including 1,500,000 employees of construction companies. All workers covered under the Act receive time-and-a-half pay after 40 hours a week unless specifically exempt.

The 40-cent wage order for the construction industry was one of the last to be issued, and became effective February 7, 1944. As under other wage orders, official posters are required to be displayed in all covered establishments, and failure to post is a violation of the order. Copies of the poster, which includes a definition of the industry and a summary of coverage under the Act, may be obtained from the national office of the Wage and Hour Division, U. S. Department of Labor, 165 West 46th St., New York 19, N.Y., or any regional or branch office.

Definition of Industry

The definition of the industry under the order, broader than the trade conception, includes all operations necessary to the industry, extending from such activities as the making of plans to the demolition of structures, and including the installation of machinery. The poster carries the following as to coverage:

"The Fair Labor Standards Act and wage orders issued under the Act are applicable only to employees who are engaged in interstate commerce or in the production of goods for interstate commerce, including those whose work is necessary to such production. Thus employees engaged in the original construction of buildings are generally not covered by the Act, with the exception of such employees as order, receive, check, unload, handle or unpack materials or equipment coming directly from outside the state, or who prepare plans, communications or other written materials or equipment coming directly from outside the state. However, employees who are engaged in the repair or reconstruction of factories or other structures used to produce goods for interstate commerce, or of instrumentalities of interstate commerce, are ordinarily subject to this Act and the wage orders issued thereunder."

Many construction-firm employees, of course, are not in interstate commerce or engaged in the production of goods for interstate commerce. The Wage and Hour Division in its day-to-day enforcement of the statute must make interpretations of the law, naturally subject to review by the courts. Its effort has been to make these interpretations for the guidance of industry as simple and reasonable as possible.

Basic in determining the applicability of the Fair Labor Standards Act to the construction industry, as stated above, is the question of whether the particular job is original construction or whether it constitutes reconstruction, maintenance, alteration, or repair of an establishment. Some courts have held that original construction, even of such structures as factories, is not under the Act. The distinctions here will be of great importance in the post-war period when the construction industry will have billions of dollars worth of reconversion work on buildings and other facilities being turned from war to peacetime use.

Employees of contractors on most road and bridge work are covered under the Act since relatively little "original" construction of roads and bridges is done. The Alcan Highway was an "original" construction project but most highway and bridge work is reconstruction, repair, improvement or maintenance of old routes. New airports, as they spread throughout the country with the growth of air travel, would constitute "original" construction, but the enlargement of existing airports would be "reconstruction," and employees engaged in such work would be covered by the Act.

Workers on flood-control projects, the construction or maintenance of which affects the navigability of streams and rivers, would be covered since they are engaged in maintaining "essential instrumentalities of interstate commerce."

(*Concluded on page 74*)

A Heater Planer working on West Seventh Street in Los Angeles, Calif.

Heater-Planer Unit For Black-Top Repair

Maintaining and reconditioning all types of bituminous surfaces can be done with the Heater Planer shown in the illustration. The Asphalt Pavement Planing Co., 4338 Sunset Blvd., Los Angeles, Calif., owns and operates a fleet of these units, which are available for rental by the day or week, or will contract for their use on a yardage basis. According to this company, this machine heats and planes off the corrugated pavement, leaving the displaced material in a continuous windrow in one operation. After planing, no other treatment is necessary.

The Planer has a wheelbase of over 20 feet, with the cutting unit 48 inches wide centrally located. It weighs over 30,000 pounds and has a low speed of 1,700 feet an hour. It is reported that planing cuts the cost of maintenance to a minimum and may be done without interference to traffic, and that it leaves the pavement smooth with a non-skid mosaic appearance.

Further information on this Heater Planer and arrangement for rental or contract work may be secured direct from the Asphalt Pavement Planing Co., 4338 Sunset Blvd., Los Angeles, Calif. Just mention this item.

Hose Accessories

The LE-HI line of high and low-pressure hose couplings, nipples, clamps and special fittings made by Hose Accessories Co., Lehigh Ave. & 17th St., Philadelphia 32, Pa., is described in literature issued by that company. Although, under the Controlled Materials Plan, orders for these products must be filled in accordance with priority ratings and then in the sequence in which they are received, the company announces that it is handling commitments with promptness and doing all in its power to fill orders without undue delay. It urges, however, that requirements be anticipated and orders placed as far in advance of actual need as possible.

LE-HI malleable-iron couplings for a wide variety of applications, from ordinary water or suction hose service to high-pressure steam operation, are described and illustrated in these bulletins. It is also stated that many LE-HI products made of brass or bronze are available for use where corrosive conditions are encountered or where the safety of non-sparking connections is paramount. The manufacturer states that there is a LE-HI coupling for every hose application, especially designed and constructed for the service intended. These products readily interchange with other makes.

These bulletins and complete data are available upon request to the manufacturer. Just refer to CONTRACTORS AND ENGINEERS MONTHLY.

Osgood-General Name Seven New Dealers

A joint announcement from The Osgood Co. and General Excavator Co., Marion, Ohio, associate manufacturers of excavating and materials-handling equipment, lists the following recently appointed distributors: Acme Equipment Co., Detroit, Mich., for the Detroit area and eight southern counties in Michigan; Arthur C. Leake, Middletown, Va., covering western Virginia and two counties in West Virginia; Municipal Sales Co., Richmond, Va., for the territory of eastern Virginia and the Virginia Department of Highways; Walling Tractor & Equipment Corp., Portland, Ore., for six counties in southern Washington and the state of Oregon; H. L. Baxter, Toronto, Ont., having the Canadian franchise for the Toronto area and additional territory in southern Ontario; Rousseau Equipment Co., Winnepeg, Manitoba, to serve the entire province; and the Dominion Distributors, Ltd., St. John's, Newfoundland, for the entire crown colony.

At present Osgood and General Excavator are fully engaged in the production of power shovels and rubber-tired crane units for the armed services, and are planning a post-war program to include a new General Type 10 rubber-tired one-man one-engine crane-shovel combination which is said to cover a wide range of jobs.

Defrosting Culverts With a Steam Lance

Minnesota Highway Maintenance Crews Use Novel Method to Open Culverts Ahead of Spring Thaws in North to Prevent Flooding of Roads

✦ THE thawing of culverts in northern Minnesota each spring is a necessary and expensive maintenance item for the Department of Highways. The long period of low temperatures permits ground water or water from short thaws to accumulate as ice in drainage structures, and its removal before the general spring thaws occur is essential to prevent flooding of sections of highways.

Equipment

The steam for this operation is produced by a Cleaver-Brooks tank car heater or by any 5 to 10-hp-capacity steam boiler. In Minnesota, all tank-car heaters are already equipped with a supply of steam hose, valves, etc., and during past years these heaters have been used for thawing out pipe culverts, drop inlets, and manholes with ordinary steam jets.

Where culverts are of a considerable size, it was discovered that it was quicker and cheaper to cut the ice into blocks rather than attempt to soften it up with steam and then break it up and shovel it out. In order to do this it was necessary to devise some special types of end nozzles to be fastened onto the end of the extension pipe ordinarily inserted in a steam hose for thawing operations. These nozzles consist primarily of a short section of ½ or ¾-inch gas pipe, closed at one or both ends and drilled with ⅛-inch steam outlets spaced 4 inches apart along one side of the pipe. These nozzles are so constructed that they may be attached as a straight extension or as a "T" attachment to the handling pipe.

Method

Where the ice is of considerable volume, such as in a 4 x 4-foot box culvert, the steam jets are so attached to the handling pipe that the ice can be thawed away next to the walls and floors of the culvert. After that has been done, the direction of the jet is changed so that the ice can be cut into sections of any desired size or shape. The rectangular chunks usually weigh from 400 to 600 pounds and are easily slid out of the culverts. This procedure takes far less time than would be required to melt all of the ice.

Any small crew of men, from two to four, familiar with using steam boilers for thawing purposes, can easily devise their own jets and their own methods on the job, according to C. L. Motl, Maintenance Engineer, Minnesota Department of Highways, to whom we are indebted for the information in this article. "Experience and local governing conditions," reports Mr. Motl, "will soon determine for the operating crew when it is most desirable to attempt to remove ice by complete thawing, by partial thawing with chiseling and shoveling, or by cutting the ice into blocks convenient for handling."

Novel "Sink" Bridge

An unusual bridge structure, with a movable span which can be submerged to a depth of 20 feet to permit the passage of river traffic, is reported on the Shatt-al-Arab near Basra, Iraq, according to a recent item in *Foreign Commerce Weekly*.

Road and rail traffic passes over the span as the weight normally is taken by two transverse bearing girders at each end. At each of the four corners of the structure there is a hand-operated hoist with cables operating over pulleys on overhead steel towers of gantry-like design. Between the hoist towers, parts of the piers are recessed to permit lowering of the span, and these recesses are spanned by the bearing girders when in position. For river traffic, the hoists lift the weight of the span off the bearing girders, which are slid back by hand, and the bridge is then lowered, leaving a 90-foot-wide channel. When rail and road service is to be resumed, the hoists lift the span above the level of the bearing girders, which are again slid out across the recesses.

The span is 92 feet, with a deck width of 15 feet, and weighs 35 tons. The bridge is said to be simple in design and operation, with piers of timber-pile construction.

New Canadian Dealer For Caterpillar Co.

Announcement has been made by F. G. Nunneley, Canadian Sales Manager, Caterpillar Tractor Co., Peoria, Ill., of the retirement of Albert Olson, owner of the Albert Olson Co., Ltd., Caterpillar representative in the Saskatchewan, Canada, territory for almost twenty years.

At the same time it was announced that the firm of Kramer-Church Tractor Co., Ltd., will represent Caterpillar in this territory, with headquarters in Regina. Both members of the new concern have been in the machinery or construction business for some time. Clarence H. Church represented Caterpillar in Canada for a number of years, and more recently has been Northern Division Manager of the Union Tractor & Harvester Co. at Edmonton, Alberta. R. A. Kramer, the other partner in the new firm, was formerly in the contracting business, having been a member of Mannix & Kramer which withdrew from business about eighteen months ago.

Inland Steel Piling Featured in New Catalog

The construction and characteristics of Inland steel piling, which is described as being made of accurately rolled steel, of high carbon and manganese content for increased strength and toughness, are featured in a new 16-page catalog just made available for distribution. In addition to the text, the catalog includes a number of photographs showing national projects, such as dams, cofferdams and breakwaters, where this piling has been used, and several pages are devoted to cross sections of the various types of piling, as well as corners and fabricated connections, splices, tapers and followers. For the convenience of contractors desiring such service, it is stated that both new and used Inland steel piling may be procured on a rental basis. The catalog also reproduces a coffer calculator especially designed to save time in figuring piling jobs, of which the manufacturer has a limited number available for those actively engaged in this work.

For a copy of Catalog No. Four, write directly on your official letterhead to the manufacturer, the Inland Steel Co., 38 So. Dearborn St., Chicago 3, Ill.

New Euclid Dealer Named for Northwest

The appointment of the Columbia Equipment Co., 1240 S. E. 12th Ave., Portland, Ore., as distributor of Euclid equipment in the territory comprising Wahkiakum, Cowlitz, Clark, Skamania and Klickitat Counties in Washington, and all of Oregon with the exception of Wallowa, Union, Baker and Malheur Counties, has been announced by the Euclid Road Machinery Co., Cleveland, Ohio. The addition of Euclid hauling equipment, it is stated, rounds out this dealer's line of contractors' machinery which also includes products of the Thew Shovel Co., Austin-Western Co., Barber-Greene Co., Le Roi Co., Ransome Machinery Co., Novo Engine Co., Standard Steel Works, and the Independent Pneumatic Tool Co.

The Columbia Equipment Co., which is headed by F. B. McBath, President, F. L. Jerome, Vice President, and R. R. Hicks, Sales Manager, maintains a branch office with a well-equipped shop and parts stock in Seattle, Wash., in addition to the main office and warehouse in Portland. The company is a member of the Associated Equipment Distributors.

The Future Status Of Secondary Roads

Serving 1/3 of the People, Farm-to-Market Routes' Importance Justifies 1/3 Of Highway Funds

By FRED R. WHITE, Chief Engineer, Iowa State Highway Commission

✦ THE term "secondary and feeder roads" as used in this discussion includes rural roads not on the Federal-Aid highway system, and highways and streets in municipalities having less than 10,000 population, which are not on the Federal-Aid highway system. The total mileage of public highways, including streets, in the continental United States is approximately 3,308,000 miles, divided as follows:

Federal-Aid system	236,000 miles
Urban highways and streets	136,000 "
Secondary and feeder roads	2,936,000 "
Total	3,308,000 "

Thus the secondary and feeder-road group is by far the largest of the three. In fact, 88.8 per cent of all our public-highway mileage is in this category, while the Federal-Aid system accounts for 7.1 per cent of the total mileage, and the remaining 4.1 per cent is in the urban-road classification.

There are no clearly defined boundaries of the areas or population groups especially served by any one of these three classes of roads. All areas and all population groups derive some service and some benefit from each. It is apparent, however, that people living outside of any municipality and people living in communities of less than 10,000 population are especially interested in the improvement of secondary and feeder roads, as that is where these roads are located.

Rural Road Service

It is of interest to note that, according to the 1940 population figures, 21,050,000 people in this country live in municipalities of less than 10,000 population, and 47,903,000 live outside municipalities. Thus 68,953,000 people, or 52.3 per cent of the 131,669,000 people in the country, are located in areas where the secondary and feeder roads are located, and would receive a large measure of direct benefit from the improvement of these roads.

The 2,781,000 miles of secondary and feeder roads located outside of any municipality constitute the life line for 92 per cent of the 6,100,000 farms in this nation. On these rural secondary roads live 44,000,000 people who have a direct interest in their improvement. That is 33.4 per cent of the total population, but all the rest of us are interested too, for we all must eat.

Traffic studies for 1941 (the last year before the war) indicate a total of 310,832,000,000 vehicle-miles of traffic per year on all public highways and streets. This annual traffic is divided among three classes of highways, as follows:

Classes of Highway	Vehicle-Miles
Federal-Aid system	99,390,000,000
Urban highways and streets	104,262,000,000
Secondary and feeder roads	107,180,000,000
Total	310,832,000,000

Thus, measured in vehicle-miles, the secondary and feeder roads carry 34.5 per cent of the nation's annual highway traffic.

Present Condition of Rural Roads

Statistical data on the present condition of improvement of the secondary and feeder roads are not available. Some states have it but, in most states, since these roads are not under the jurisdiction of the state highway department, no record of the secondary-road condition is available for the state as a whole. It is known that in some states a very considerable percentage of the secondary and feeder-road mileage has been improved and has some type of surfacing.

For example, in the state of Iowa, 46,970 miles or 50 per cent of the total of 93,900 miles of rural secondary roads have been surfaced in some manner. Of this, 99.8 per cent is a light cheap surfacing, with topsoil, gravel or crushed stone. Only 0.2 per cent is pavement or treated with bitumen. A very large percentage of this surfaced secondary-road mileage in Iowa must be completely reconstructed, regraded and resurfaced before it can be presumed to meet present-day secondary-road traffic requirements. Many thousands of miles of these surfaced secondary roads never were built to established grade and standard cross section. They were simply crowned up with a blade grader to get the water out of the middle of the road, and a light layer of gravel applied, in a thrifty effort to get a maximum mileage out of

(Continued on page 54)

Diesel Generator Sets For Low-Cost Power

A line of diesel generator sets, both ac and dc, suitable for generating power for construction equipment, gravel plants, machine shops and similar applications, is described and illustrated in a four-page folder issued by the Murphy Diesel Co., 5319 W. Burnham St., Milwaukee 14, Wis. Said to produce electricity for 1 cent per kwh under average conditions, these generator sets are described as sturdy and compact, with low operating and maintenance costs, and are available in five sizes, ranging from 60 to 115 kw, with right or left-hand control as desired. The illustrations show several models and installations, including a single portable skid-mounted diesel used on a dredging operation.

Copies of this descriptive folder may be secured upon application to the manufacturer and reference to this item.

Steel Sheet Piling Bulletin

Corrugated steel sheet piling for sewers, sewage disposal plants, dams, cofferdams, bridges, bulkheads and like purposes is described in a single-page bulletin available from the Caine Steel Co., 1820 No. Central Ave., Chicago 39, Ill. This piling, which is available in both standard section and rolled interlocking construction, is described as economical, watertight, and easy to handle, either by hand or power. It is made in weights of 10.74 to 6.84 pounds per square foot for the standard construction and 11.70 to 7.42 pounds per square foot, or 13.61 to 8.66 pounds per linear foot, for the interlocking type.

Interested contractors and engineers may secure copies of this descriptive folder by writing direct to the manufacturer. Please mention this publication.

New Davey Eastern Mgr.

S. J. (Jack) Perlow, formerly associated with Johnson, Drake & Co., contractor, on Army Base construction projects in Eritrea and Egypt, has been appointed Eastern Manager for the Davey Compressor Co. of Kent, Ohio, with his headquarters at 330 W. 42nd St., New York City.

After foreign service in World War I, Mr. Perlow attended the Massachusetts Institute of Technology and since then has devoted many years to air-compressor and air-tool engineering, installation and sales.

Suggested Procedure For Airport Sodding

Aids to Contractors and Airport Managers on the Buying, Cutting, Laying Of Sod; Time Studies

By FRANZ A. AUST, Consultant, Madison, Wis.

✦ "WHY is sodding, like seeding, usually included in initial contracts?", is often asked by contractors. The answer is that it prevents erosion as soon as the job is finished, instead of throwing the load of curing erosion on later maintenance work. Erosion varies in kind. There is the gullying type, sheet erosion, and sloughing due to frost or excess moisture in the subsoil. What is more serious, on airports, is wind erosion, caused by the terrific blast of the propeller slipstream as planes taxi, test their engines, and wait their turn to take off. When the erosion is due to moisture, erosion control has two objectives: to keep the soil in place and to prevent drainage channels from becoming silted. In the case of wind erosion, it is more important to keep dust from damaging the engines. Dust, picked up by the motors as planes are landing or taking off from airports, is more devastating to the vital parts of the engine than many hours of actual use.

Although sodding is usually considered as one of the most expensive types of soil erosion control, it is recognized as the most satisfactory treatment for immediate effects.

Planning a Sodding Job

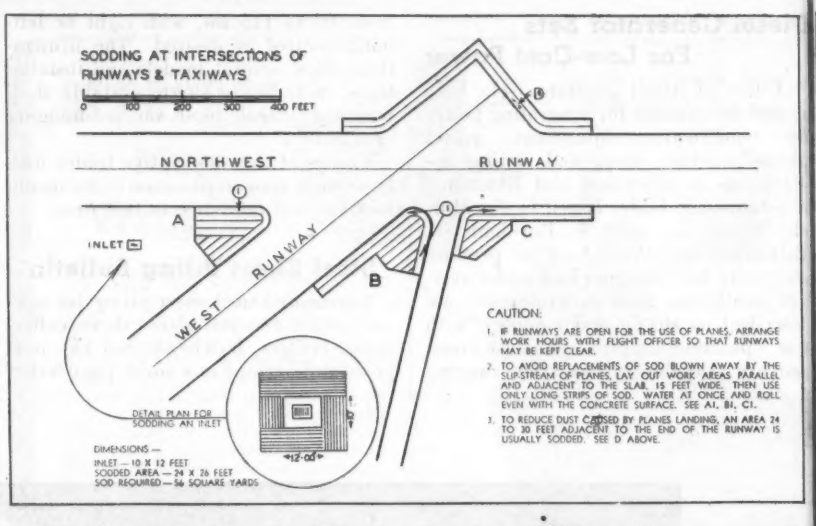
Any large-scale sodding operation requires a carefully organized work plan if the task is to be efficiently and effectively done. The size of the individual areas to be sodded, their relative length and width, as well as the distribution of the entire area of the sections to be sodded, are important factors to take into consideration. The areas encountered in airport work vary greatly in size. The smaller ones surround drain inlets and require only 25 to 75 square yards at each location. There may be 50 to 70 inlets scattered widely over the field.

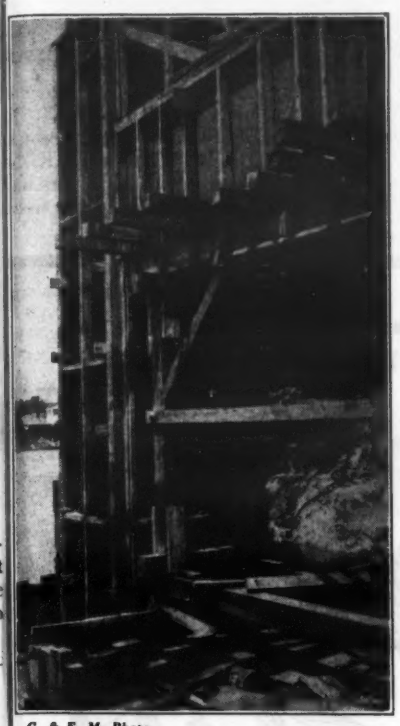
Sometimes a strip of sod 10 to 15 feet wide is specified on each side and for the entire length of a new runway. At the intersection of two runways or a taxiway and runway, the place to be sodded may require as much as 1,000 square yards, seldom less than 200. If the apron is to have intensive use, a strip 30 to 100 feet wide adjacent to, and as long as, the apron is often sodded. Areas to be sodded are usually not indicated on the construction plan. Their location is often determined by the using agency when the grading job is nearly completed. All of these factors make it difficult but nevertheless essential to have a carefully studied and arranged work plan where the small and scattered areas to be sodded are fitted into the larger program.

The way in which the work is planned will depend upon the season of the year and the extent of the individual areas. Large areas may be divided into 24-foot strips, all paralleling the concrete. In hot weather, where the sod must be thoroughly soaked a few hours after it is laid, 24-foot widths are especially convenient. The tank truck then drives either on the pavement or bare ground and easily waters the entire strip.

If runways are already in use, certain precautions and approved sodding practices are essential: (1) Time all operations so that runways may be cleared of traffic, by the proper authority at the tower, for the length of time required for sodding that location. (2) Warn all workmen to be continually on the lookout for approaching planes. (3) Lay out the first area, at least 9 feet wide, parallel to the edge of the runways and the arc of the connecting curve. Unroll the sod parallel to the runways and not at a right angle. (4) The succeeding work strips, farther from the concrete surface, may be parallel to either runway, depending upon which runway must first be released to traffic. (5) Establish the finish grade adjacent to the runway so

(Continued on page 40)





C. & E. M. Photo
A detail of the forms for a column and cross beam for the south pier of the LeJeune Road Bridge in Coral Gables, Florida.

New Concrete Bridge Built by Fla. County

(*Continued from page 7*)

Concreting

All of the concrete for the job was mixed in a Rex 3-bag mixer located on the south bank. The aggregates were stockpiled on the pavement of the approach roadway, weighed on wheelbarrow scales, one for rock and one for sand, and the mixed concrete delivered to a bottom-dump bucket which was swung by a home-made derrick on a 60 x 25-foot steel barge. The forms were handled by a truck-crane on a smaller wooden barge.

For work on the north side of the bridge, the concrete was swung from the south side of the derrick, while the south side was poured direct or by buggying the concrete over runways to the location of pouring. All concrete was vibrated by a Small Tools Co. mechanical vibrator. The pour for three columns and the cross beam was 25 cubic yards, which was completed in 4 hours. This was the largest single pour on the structure. The concreting crew consisted of fifteen men.

The side forms for the beams were stripped the second day after pouring, while the specifications called for leaving the beam-bottom forms and falsework in place for 21 days. However, if the test beams broke at a satisfactory figure at an earlier date, stripping was permitted then.

Major Quantities

The major quantities on this relatively small bridge were:

Excavation, wet	300 cu. yds.
Excavation, abutment	80 cu. yds.
Concrete, tremie	120 cu. yds.
Concrete, piers and abutments	226 cu. yds.
Concrete, deck slabs	144 cu. yds.
Reinforcing steel	51,000 lbs.
Structural steel	146,000 lbs.
Fenders, treated-timber	7 MBM
Piling, untreated	1,980 lin. ft.
Hand-rail	244 lin. ft.

The contract cost was $49,885.

Personnel

The contract for the construction of the new concrete and steel-center-span structure across the Coral Gables Waterway at LeJeune Road was awarded to Powell Bros., Inc., of Fort Lauderdale, Fla. R. J. Herrick was Resident Engineer for Dade County.

Robot Oil Reclaimer Described in Folder

A 4-page folder has been issued by the Youngstown Miller Co., Sandusky, Ohio, describing and illustrating its new Robot Oil Refiner for removing fuel dilution, water, acid, sludge material, dirt and other contaminants from all kinds of lubricating, hydraulic, cutting and vacuum-pump oils so that they can be re-used. The Robot, it is stated, employs the same process used by the manufacturer for over ten years in batch oil reclaimers, with the new feature that operation is automatic and continuous. The folder discusses the principle on which the machine operates and includes a chart outlining the course of the oil through the machine. Capacities range from 4 gallons per hour to 3,000.

Copies of Bulletin YM-700 may be secured upon application to the manufacturer, who will also be glad to submit definite recommendations as to the proper Robot size required upon receipt of engine data including model, hp, rpm, gallons of oil in the system to be served, and the number of hours each engine is in operation.

Lee J. Cronkhite Dies

Announcement has been received of the death of Lee J. Cronkhite, Manager of the Portland, Ore., branch of the Fruehauf Trailer Co., Detroit, Mich. Mr. Cronkhite, a native of Fergus Falls, Minn., was regarded as an authority on highway motor transportation and had a wide experience in the field, having been connected with the J. F. Hickey Motor Car Co. of Tacoma, representing White motor trucks; the Isaacson Iron Works; and in 1939 became a partner in the Motor Truck Equipment Co., of Seattle. Following the absorption of this company by Fruehauf in 1940, Mr. Cronkhite became Manager of its Portland branch. He was Vice Chairman of The Society of Automotive Engineers, Oregon section, and a member of the Associated General Contractors.

Safer Winter Roads Urged for 1944-45

Safer driving conditions for the motorist who must use his car daily, as well as for the all-important transportation of war and essential civilian goods, can be obtained in northern states this winter even with depleted snow-removal crews, according to the National Safety Council. In a bulletin recently issued by its Committee on Winter Driving Hazards, the Council urges prompt mobilization of equipment for snow removal at the start of a storm and recommends several methods of keeping traffic lanes free of ice and snow.

The highway engineer's responsibilities to see that transportation arteries are free and clear and to keep down the winter traffic-accident toll are amplified by wartime conditions, the bulletin states. Results of more than 3,000 tests made by the committee reveal that braking distances on ice and packed snow range from three to eleven times that on dry pavement.

Several methods are suggested by the committee for obtaining bare pavements after a snowfall. If started early in the storm, snow plowing alone will accomplish this task. Another effective and economical method involves the use of either sodium chloride (rock salt) or calcium chloride alone. Spreading minimum amounts of pure chlorides, after the snow has fallen to a depth of ½ to 1 inch, melts the snow and forms a brine between the packed snow and the pavement. This allows relatively easy removal by plowing.

Conventional abrasive-chloride mixtures are also used for winter road maintenance, but they do not result in bare pavements. Braking distances on sanded ice are half those on glare ice but four times those on bare pavements.

The use of chlorides alone has two distinct advantages, the committee says. It eliminates extra plowing, which is important in view of the man-power and equipment shortages, and it avoids the need for removal of abrasives from catch basins and drainage ditches.

"There was never a more urgent need to get traffic through on time with safety," the bulletin concludes. "The road maintenance job must be done to the greatest possible extent, but especially on the principal roads carrying essential military and industrial traffic. Traffic must move freely and safely this winter."

World Bestos Appoints New Service Engineer

Announcement has been made by the World Bestos Corp., Paterson, N. J., manufacturer of Grafild brake linings, of the appointment of Ernest W. Kisby as Service Engineer. Mr. Kisby has had a wide experience in the automotive field.

Post-War Road Work Being Planned in N. C.

(*Continued from page* 8)

been made to secure additional engineers for design and location work, but apparently they are not available, at least at salaries which we are in a position to pay.

It is doubtful if we can make very much headway in increasing our personnel until some time after the war ends. It is estimated that the personnel now in the Drafting and Design Departments is sufficient to prepare the plans on only about $4,000,000 of construction per year. The actual amount of money, of course, depends upon the type of projects involved. Until recently, at least one-half of these forces have been busy in the preparation of plans for access roads to military camps, sources of raw materials, etc. It has, therefore, been possible to utilize only one-half of this personnel in the preparation of plans for post-war work.

It should be possible to transfer a large number of men from construction to drafting and design, but these men have gone to work in war industries or have entered the armed services at such a rate that we have at times been embarrassed by the lack of engineering personnel to take care of the supervision and inspection of the necessary access-road construction. At the present time, we have in our employ only about 10 per cent of the engineers who were on construction prior to the war and, therefore, we cannot look to the transfer of these men to aid materially in the preparation of necessary plans and specifications for post-war projects.

Status of Funds

There are ample funds available for surveys, preparation of plans, and for securing the necessary right-of-way for the post-war program. The allotment to North Carolina from the $10,000,000 advanced engineering appropriation made by the Federal government was $238,730, and the allotment from the $50,000,000 of regular Federal-Aid funds made available by Congress last year for surveys and preparation of plans is $1,236,000. Both of these funds have to be matched with a similar amount of state funds which will make the total amount of $2,949,460 available for surveys and plans, without utilizing any state funds over and above the amount required to match the Federal funds.

There are ample state and Federal funds available for securing the necessary right-of-way for projects as rapidly as the plans can be prepared, so this phase of the work may be carried on. At the end of the past fiscal year, on June 30, 1944, we had a surplus in the highway fund of approximately $32,000,000, a portion of which can be used to match Federal-Aid funds for new construction.

However, as a result of the restrictions on maintenance work since the beginning of the war, it will be necessary to use from $10,000,000 to $15,000,000 of this surplus to take care of what might be termed "deferred maintenance" in order to bring the maintenance of the road system up to the proper standard. In making this estimate of extraordinary cost of maintenance, we have kept in mind that we shall have a considerable amount of construction going on at the same time, which will assist in reducing the maintenance problem.

A law passed by the last Legislature will enable this Commission to issue approximately $15,000,000 in bonds if necessary to carry on construction after the war. While there has been a very material reduction in the amount of highway revenue since the rationing of cars, gasoline and tires, it is believed that, with the amount of surplus we now have, and the expected increase in revenue when rationing is lifted, there will be sufficient to match a very substantial Federal program the first few years after the war, without the necessity of floating a bond issue.

Progress of Plans

As stated before, the present personnel in the Design and Drafting Departments is sufficient to take care of only approximately $4,000,000 of plans per year, and is entirely inadequate to handle the preparation of plans for the expected and badly needed post-war program. At the present time we have completed plans for approximately 205 miles, amounting to an estimated cost of $5,450,000. Plans are about 50 per cent completed on an additional 227 miles of highway, which are estimated to cost $7,758,000. In addition, we have surveys under way or completed on approximately 540 miles of highways, estimated to cost $21,000,000, so it can be seen that our greatest need at this time is additional draftsmen and designers to speed up plan work. We are not very optimistic about securing the needed additional personnel, but we are making every effort to increase our production of plans and are hopeful that some way may be found to speed up this work so that we shall be able to handle as large a program as it will be possible to secure materials, equipment and other needed items to carry on.

We are proceeding with the acquisition of rights-of-way for projects on which plans have been completed, and expect to continue this work as rapidly as plans are finished. No delay is anticipated in the letting of contracts on account of the necessity of securing right-of-way.

The Task Is Great

Due to the age of our trunk-line highway system, the task of rebuilding it at the end of the war will probably be greater than in many states. Since July 1, 1941, the North Carolina State Highway Commission has let to contract practically no work that would benefit the trunk-line system, while prior to that time we were doing an average of approximately $15,000,000 of construction each year. If this construction, involving the widening, relocation and rehabilitation of the state highway system, is postponed for only four years, it will mean that we have lost approximately $60,000,000 of new construction and, in addition, the wear and tear on these roads have been very materially accelerated, due to heavier traffic and less maintenance. It can therefore be seen that we shall have a tremendous problem after the war to bring our road system up to the proper standard for expected traffic at that time. While the picture is not very bright now, we believe we shall be ready to handle as much construction as other controlling factors will permit on an economical basis.

Paper is vital to Victory. Conserve it and contribute all waste paper promptly to your local salvage committee.

Roads Built to Aid Canol Pipe-Line Job

Rail and Water Haulage Could Not Get Pipe In So Army Engineers and Contractors Opened Needed Roads

By CHARLES M. UPHAM, Engineer-Director, American Road Builders' Association

✦ THE Canol oil-supply project in Alaska and Canada (See C. & E. M., June, 1943, pp. 34-35) is now completed for 1,600 miles, thanks to the roads that were constructed by the Army and contractors for the transportation of machines, materials and men. The project was designed to supply gas and oil to the interior of Alaska and to the airports on our main interior air routes to Alaska.

Although the main transportation route from Edmonton in Alberta to the oil fields at Norman Wells is by rail and water, it includes a 16-mile portage by-passing a series of rapids on the Slave River. Originally this portage consisted only of a poor road but the Army rebuilt it into a high-class highway that would stand up under the heavy loads imposed upon it.

Also, a job for road builders was the construction of ten landing strips which were built along the water route as fast as equipment could be sent in. Long runways were graded and surfaced with gravel in an average of three weeks each. Once the air route was completed, it was used for flying in men, emergency rations, small tools and supplies. This was important, for otherwise it took from three to four weeks to transport men by rail and boat from Edmonton to Norman Wells when the weather was good; longer when storms interfered.

To aid in the delivery of materials and supplies all the way to Norman Wells, the Army built two winter trail roads into the project. They were used principally to transport heavy construction equipment. The big job in pipe laying was the 600-mile stretch between Norman Wells and Whitehorse, because of the difficulty of access to this part of the work. The pipe could not be laid until the road was cut through, over which pipe and pumping station equipment and construction camp supplies could be transported. This stretch was worked from both ends, with the Engineer regiment split into four parts. One group started at the Teslin River and worked northeast, while the other three moved over frozen ground with road-building equipment to three interior locations. The spring break-up isolated these units, but they were able to work both ways from their winter camps and finally, by building a pioneer road similar to that in the first stages of the Alaska Highway construction, connected up the various sections by the time the Engineer troops moved out. Meanwhile, the contractor also started road construction from the Canol Camp and, across the river from Norman Wells, toward the mountain pass on that side.

The crude-oil pipe line crosses the Mackenzie Mountains through a pass close to a 5,000-foot elevation. This range had never been explored, much less surveyed, so the route was tentatively located by aerial reconnaissance, supplemented by forays on foot. But the final location was made by the road-building crews, who worked their way through the canyons, sometimes being forced to go back and try another gulch when the going got too tough. When the Army road builders pulled out of the south end of the line, the contractors took over, improving the Army trail road into one suitable to handle the big pipe trucks and trailers.

On the remainder of the project, access to the pipe line was easy, either by the Alaska Highway or the railroad. The pipe follows the road, though some supplemental clearing for the pipe-line right-of-way was necessary.

North Dakota Snow Is a Major Problem

With Many Miles of Roads, Scattered Population and Limited Funds, State Keeps Main Roads Open to Traffic

(*Photos on pages* 1 *and* 88)

✦ DESPITE snowfall which runs from 50 to 80 inches annually in about 25 per cent of the state's area, the North Dakota State Highway Department does an effective job of keeping the main roads open to traffic throughout the year. With this heavy average snowfall in a large part of the state and a minimum of 20 inches in any part, a highway mileage of 6,559, and a gross highway income of a little over $3,000,000 annually, the state deserves considerable credit for the efficient handling of a difficult problem.

Like other maintenance work in North Dakota, snow removal is handled through seven division engineers located at Bismarck, Grand Forks, Valley City, Devils Lake, Williston, Minot, and Dickinson, all of whom work under the direction of Ray Robinson, State Maintenance Engineer. Due to the necessity for transferring equipment from one division to another as the locality of the heaviest snowfall demands, the central office exercises more direct control than is perhaps the case in some other states. Ordinarily $200,000 is allotted to the actual work of snow removal, with an additional $40,000 provided for preliminary remedial measures and sanding, but these amounts do not always prove sufficient.

The Department has available 7 rotary plows, 18 V-plows for use on motor graders, and 29 V-type heavy-duty plows, 28 V-type medium-weight plows, 23 V-type light-weight plows, and 6 one-way plows, mounted on trucks of varying weights and horsepowers which are used on other work during the summer months. The types of plows used are as follows:

ROTARY PLOWS
7 Snogos

V-TYPE PLOWS FOR MOTOR GRADERS
4 Galion
4 Caterpillar
5 Austin-Western
2 Adams
1 Iron Range
2 North Star
1 Shop-Made

V-TYPE HEAVY-DUTY TRUCK PLOWS
5 Wausau
5 American
3 Iron Range
4 Frink
3 Wisconsin Special
5 Bros
2 North Star
1 Ross
1 Austin-Western

V-TYPE MEDIUM-WEIGHT PLOWS
5 Bros
9 American
4 Ross
4 Frink
1 Austin-Western
2 North Star
2 Sargent
1 Wausau

V-TYPE LIGHT-WEIGHT PLOWS
1 Good Roads
4 Baker
1 Wisconsin Special
17 Wausau

ONE-WAY PLOWS
5 American
1 Austin-Western

As is true in so many other states, it has been impossible to carry on the normal replacement program for snow-removal equipment, and the attempt to keep it in first-class operating condition has been seriously hampered by the shortage of man-power, repair parts, and critical materials.

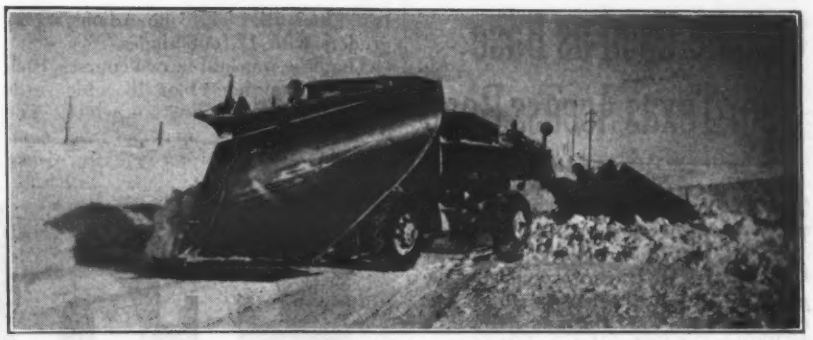
Drift-Prevention Measures

It has been found possible in North Dakota to lighten the snow-removal task somewhat by the prevention of drifting. Much of the state system is in open-plains country where an unobstructed wind will keep the highways clear of snow with only moderate assistance.

Streamlining of cut sections has proved to be very effective, particularly in the shallow cuts which have always given the maximum trouble, and it is felt that expenditures for this purpose are well justified. Except in the early autumn when snow storms are apt to occur without much wind but with considerable moisture in the snow, properly streamlined cuts with flat and rounded backslopes tend to keep themselves almost as clear of snow as the long open embankments.

During the snow season, this streamlining theory is further carried out in cuts where it does not exist in the grading by cutting down the existing snow banks. Shop-built back slopers remove the tops of the snow storage banks, trimming them down to a very flat slope and dragging the excess snow down into the road, from which it is thrown out by rotary snow plows which can travel at

(*Concluded on page* 68)



A North Dakota Highway Department truck with V-plow stops to pull out a stalled truck loaded with coal.

Caliche Used as Base For Texas Access Road

(*Continued from page* 1)

Three water trucks of 1,000-gallon capacity applied water by gravity, as two 42-inch sheepsfoot rollers pulled by Caterpillar RD7 tractors compacted the grade to a Proctor density of 90 per cent. Water was obtained from the Dalhart municipal and Army Post water systems. Two No. 12 Caterpillar motor graders and a LeTourneau bulldozer mounted on an RD7 assisted in the grading operations and finished the shoulders.

Caliche Base

Caliche for the flexible base was obtained from a pit approximately 2 miles beyond the northeast end of the job, since all material available in pits adjacent to the job had been used previously in the construction of the Army airfield to which this new route provides access. At this pit, 6,000 cubic yards of stripping was necessary, this material being stockpiled and replaced in the pit after the required amount of caliche base had been obtained. Scrapers were used for this work.

A Schramm 150-cubic-foot compressor furnished air for the Cleveland wagon drill used for drilling 11-foot holes, spaced on approximately 8-foot centers, which were loaded with 40 per cent gelatin dynamite and exploded by electric caps. A Lorain 75-B shovel loaded to four 4-cubic-yard trucks which hauled the material to a Pioneer crushing and screening plant, dumping from a ramp to one of the two primary crushers. The caliche was crushed to a maximum size of 2 inches with all fine material retained.

Forty trucks were available on the job for base haul but, due to the shortage of drivers and parts, it was impossible to operate an average of more than twenty, with a maximum of thirty-four, at any particular time. For this reason, the average production remained low, 1,200 cubic yards being the best day recorded. Due to the difficult hauling conditions on the road, approximately 20 per cent of the base material produced by the crusher was stockpiled nearby and loaded later by a ½-cubic-yard Speeder shovel when hauling conditions were more favorable.

Because of the heavy traffic using the road during the entire construction period and the possibility of rain and snow, it was not considered advisable to leave the subgrade open for a very long time. Therefore the earth work was built to a grade slightly below the finished grade of the flexible base and with a 2-inch crown. Just prior to placing the caliche base, a trench 26 feet wide and averaging 3 inches in depth was bladed out and the material used to build up the shoulders to form a trench 8 inches deep for the flexible base. This work, as well as the spreading of the base material, was done by two Caterpillar and one Adams motor graders with 12-foot blades.

The base was laid in two courses, each course containing 41 or 48 cubic yards per station, depending on width. The 6 inches of loose material was compacted to 4 inches, water being furnished by the same water trucks used in the grading operation. Because of the heavy traffic conditions, it was necessary that all material delivered during the daytime be spread and compacted each night, final compaction being obtained by a Star 10-ton 3-wheel roller. The first course was completed for the entire project before the second course was begun.

In spite of the heavy traffic all during the construction period, excellent results were obtained on this base, with no

(*Concluded on next page*)

Change of Address

(Mail to Contractors and Engineers Monthly, 470 4th Ave., New York 16, *today*)

From _____
(Former address)
_____
_____
To _____
(New address)
_____
_____
Name_____
Firm_____
Position_____

DBST on New Route To Airfield in Texas

(*Continued from preceding page*)

heavy pitting or disintegration. A few small soft spots developing under traffic, caused by pockets of excessive moisture, were bladed out, dried, and the material re-used. The slight irregularity of surface which developed under traffic was eliminated by wetting and blading immediately prior to the application of the surface treatment. This work was done in 2-mile sections. The final operation was sweeping of the base by a Grace rotary broom.

Double Surface Treatment

Gravel from commercial producers was shipped in two sizes, ⅝ inch to No. 10 screen and ⅜ inch to No. 20 screen, to a siding near the center of the job where a Northwest crane with a ½-yard Blaw-Knox bucket on a 40-foot boom unloaded directly to trucks which deposited the gravel in three conveniently located stockpiles. When application started, the same crane was moved to the stockpiles and reloaded the material as needed.

Asphaltic cement of 200 to 300 penetration was shipped from the plant of the Rock Island Refining Co. at Duncan, Okla., to the same siding used for unloading gravel. Heated by a Grace two-car heater, the asphalt was transferred directly to the 1,250-gallon Etnyre distributor with 24-foot spray bars. The first application was 0.35 gallon per square yard at a temperature of 350 degrees, which was covered with the larger gravel, placed by a Buckeye 12-foot spreader box at the rate of 1 cubic yard per 100 square yards. Spread lightly by an Allis-Chalmers 4-wheel rubber-tired tractor with a 10-foot blade attached, and rolled by an Ingram 6-ton roller, this cover coat was followed by an application of 0.30 gallon of the same asphalt per square yard, covered in turn by the smaller gravel spread at the rate of 1 cubic yard to each 140 square yards. Blading and rolling were continued for two consecutive days, with additional rolling when required.

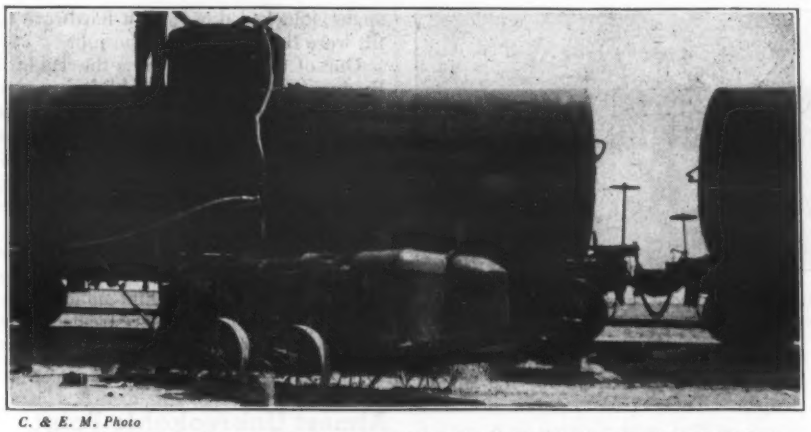
Major Quantities

This job included the following major quantities:

Excavation	102,000 cu. yds.
Haul, cu. yd. ¼-mile	45,000 units
Stripping	6,000 cu. yds.
Flexible base (8-inch compacted)	35,200 cu. yds.
Additional ¼-mile haul	736,000 cu. yds.
Asphalt, OA 200 to 300-penetration	66,600 gals.
Aggregates for surface treatment	1,800 cu. yds.
Concrete in head walls	44 cu. yds.
24-inch plain-concrete pipe	296 lin. ft.
30-inch reinforced-concrete pipe	264 lin. ft.
36-inch reinforced-concrete pipe	308 lin. ft.

Personnel

The contract for this 7.6-mile double bituminous surface treatment on a caliche base near Dalhart, Texas, was awarded on August 28, 1943, by the Texas Highway Department to McKinney Construction Co., Marshall, Texas, and allowed 75 working days for completion. The contractor operated under difficulties, as the route was in constant use, and provision had to be made for moving traffic over the shoulders and ditches at times. J. E. Freeman was Superintendent for the contractor, and V. J. McGee was Resident Engineer for the Amarillo District of the Texas Highway Department, of which J. G. Lott is District Engineer. D. C. Greer is State Highway Engineer of Texas.



C. & E. M. Photo

A Grace two-car heater was used to speed the unloading of tank cars of asphalt for a 7.6-mile access road near Dalhart, Texas, for which McKinney Construction Co. of Marshall, Texas, was the contractor.

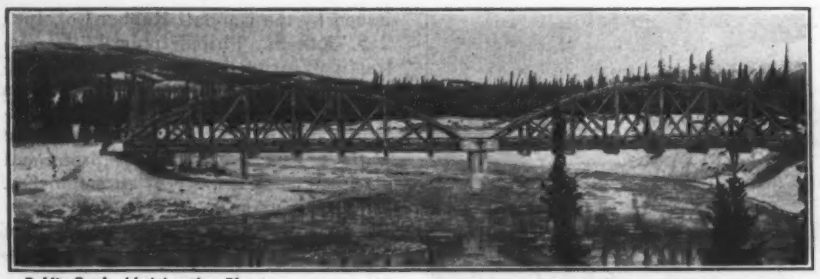
Hose Conservation Data

What to do and what not to do with air hose, water hose and steam hose in order to conserve these essential products is told in three loose-leaf bulletins issued by the Goodall Rubber Co., Inc., 2 S. 36th St., Philadelphia 4, Pa. Attractively printed on different color paper, and with the most important ideas high-lighted in boldface type, these bulletins are suitable for pinning on the walls of shops or in other prominent places to catch the eye of all employees.

Copies may be secured from the main office of the company in Philadelphia or from the Goodall branch nearest you.

Armco President Honored With Engineering Degree

The honorary degree of Doctor of Engineering was conferred on Charles R. Hook, President of the American Rolling Mill Co., Middletown, Ohio, by the Stevens Institute of Technology, at its 72nd commencement in June. In addition to serving as President of the American Rolling Mill Co., Mr. Hook is a member of the National Industrial Conference Board and of the Business Advisory Council of the U. S. Department of Commerce.



Public Roads Administration Photo
Bridging a tributary of the Yukon River, the Takhini crossing consists of two prefabricated Wolmanized 160-foot timber through trusses.

Salt-Treated Spans On Alaska Highway

Permanent bridges have now largely replaced the many temporary river crossings on the route of the Alaska Highway. Many of these are timber structures, fabricated to blueprints and treated hundreds of miles from their erection sites. The Public Roads Administration, a leader in the successful introduction of prefabricated bridges in highway construction before the war, ordered several 160-foot through trusses for the Alaska project. These trusses were prefabricated, treated, and shipped to a central point on the highway from which they could be sent to whatever sites required them.

These spans were fabricated by the Wauna Lumber Co., Wauna, Ore., treated with Wolman salts at the Oregon plant of the American Lumber & Treating Co. of Chicago, and the complete spans, knocked down, with hardware to fit, were then shipped to the job.

One of these structures is the Takhini Bridge, which carries the highway over a tributary of the Yukon. This bridge consists of two 160-foot spans of the bow-string type, erected by the Bates & Rogers Construction Corp., of Chicago. One of the single spans crosses the Desadeash River.

The saving of time and labor in the erection of prefabricated spans, and the reported lowering of maintenance costs where the timber is pressure-treated, suggest a wider use of standardized bridges in post-war road construction.

Almost Unbreakable Point Features Templar Pencils

A simple scale test is used by the Reliance Pencil Corp., manufacturer of Templar DuroLead pencils, to demonstrate their almost unbreakable points. Placing the pencil point on an office scale registering 10 pounds or more, and applying pressure, it has been proved that Templar pencils will resist a pressure one-half to two-thirds greater than other commercial pencils before they snap or break, the manufacturer reports.

After years of research, this company developed a patented lead with greatly increased strength, at no sacrifice of smooth, clear writing qualities. In addition, an exclusive process of bonding creates a complete fusion between lead and wood, resulting in longer pencil writing life.

To take care of all types of writing and drawing requirements, Templar DuroLead is made in a wide range of six degrees, from No. 1 to No. 4. Samples in any one of the six degrees may be obtained by writing on your company or official letterhead direct to the Consumer Service Department, Reliance Pencil Corp., 22 South Sixth St., Mount Vernon, N. Y., and mentioning this magazine.

Wood-Concrete Piles At Naval Air Station

Long Composite Piles with Concrete Tops Above Low Water Level Driven for Building Foundation

✦ At a Naval Air Station on the Pacific Coast a contract under competitive bids was recently awarded for the driving of 3,200 composite piles in an area to be used later as the site of an Interim Repair Shop. Although plans and specifications for the structure were not yet complete, it was felt that the advantage of an early start on the project, frequently obtained by a cost-plus-a fixed-fee agreement, could be secured without any of the undesirable features attendant on that type of agreement. The contract for site grading, pile driving and foundations was awarded to Cahill Brothers of San Francisco, with Raymond Concrete Pile Co., of New York City, subcontractor on the pile driving.

At this Station, where the highest ground elevation is only 5½ to 6 feet above the usual high tide, it is necessary to erect all important structures on a pile foundation, but due to the depth of the alternately wet and dry area lying between high and low-tide stages, all-wooden piles are not satisfactory. Because of these conditions, the contract called for the driving of wooden piling, both Oregon Douglas fir and California Ponderosa pine being used to expedite construction, cut off below the level of the water table and capped with a poured-in-place concrete pile top. The wooden piling ranged in length from 35 to 75 feet, with 75 per cent approximately 45 to 50 feet long.

Piling was trucked to the material yard, either from point of origin or railhead, unloaded on runs constructed of 12 x 12-inch timber and rolled by laborers with canthooks to the boring and heading machines. Two men using a Sioux heavy-duty electric drill bored a 1¾-inch-diameter hole into the longitudinal axis of the pile 10 inches from the butt end. This hole, which later served as a seat for the bolt anchoring the concrete pile top in place, was used as a guide for the Raymond Concrete Pile Co. heading machine. This machine, hung by a Yale & Towne ½-ton chain block from a wooden stiffleg derrick, shaped the top 18 inches of the pile to a 10-inch-diameter circle concentric with the tie-bolt hole previously bored. When the head had been shaped, a patented casting, having female threads to hold the tie bolt, was inserted in the hole and fastened by a pin driven through the pile at right angles to its axis.

A Caterpillar RD7 tractor was used to drag the piles from the heading machine to points from which they could be reached by the driving rigs.

Driving Wood Piles

The skid pile drivers, having 60-foot leads and one 18-foot-radius swinging driver with 85-foot leads, all designed and built by the Raymond Concrete Pile Co., and using 5,000-pound Vulcan single-acting steam hammers with special Raymond patented heads, drove the wooden piles to a bearing of 25 tons. Since no splicing was permitted in the wooden piles, and cut-offs of the processed heads were not economical, it was often necessary to drive a second pile where the first one driven proved to be of improper length. Each of the three drivers, operating 9 hours per day, averaged 20 completed piles driven to the required bearing, with their tops at or below the water table. An 18-foot mandrel was used to protect the specially shaped head of the wooden piles during driving. Steam for the hammers and hoists was furnished by oil-fired boilers, fuel for which was delivered in 55-gallon drums by the same tractor used to drag in the piling. The fuel was pumped from the drums into a storage tank mounted on the drivers and fed into the boilers by a steam jet.

The crew of each pile driver consisted of a foreman, an operator, a fireman, and four pile-bucks.

Concrete Pile Tops

When the top of the wooden pile had been driven flush with the ground, driving was suspended long enough to place on the shaped top of the wooden pile a 14-inch-diameter hollow cylinder made of 12-gage metal having a special bottom casting which fit closely the 10-inch-diameter tenon at the head of the wooden pile. The mandrel was then re-inserted inside the metal cylinder and driving continued until proper bearing had been secured, with the top of the wood pile at or below the water table. A ¾ x 36-inch dowel having an upset threaded head was then screwed into the casting previously placed in the wooden pile and allowed to extend upward into the metal shell, thus forming a tie for the concrete to be placed later. A reinforcing cage consisting of six ½-inch bars with a spiral wrapping of ¼-inch wire was placed inside the metal shell which was then filled with concrete delivered in truck mixers from a nearby commercial concrete plant. The metal shells were normally 8 feet in length but were cut off or extended as the finished elevation of the composite pile and the depth to which the wooden pile had been driven below water table made necessary. The ½-inch rods were long enough to project above the finished grade of the composite pile and were bent down and out to form a tie between the pile and the footing or floor which was to be poured later.

Contract and Personnel

The contract for site grading, pile driving, and foundation construction was awarded by the Bureau of Yards and Docks, U. S. Navy, to Cahill Brothers of San Francisco, Calif., on the low bid of $236,000, on November 27, 1943, with the scheduled completion date January 27, 1944. Preparation and driving of the composite piles was sublet to the Raymond Concrete Pile Co., New York City, while the remainder of the work was done by Cahill Brothers, with Dave Lewis as Superintendent. The construction was supervised for the Navy by Lieutenant Miles C. Newton, (CEC) USNR, Resident Officer in Charge of Construction, with W. A. Burris as Chief Inspector.

It has been well said, "No kind of expert opinion in this country costs so little to obtain as the expert opinion of a guaranteed bid by contractors who will back up their testimony with their own cash."

Erosion control is the most important wartime activity of Maryland's Roadside Development Department. Above grass coming through fabric placed on the drainage area of a center park on a Maryland highway to prevent erosion before the establishment of a grass cover. Right, contour trenches ready to receive topsoil and honeysuckle plants on a roadside slope.

Roadside Development On Maryland Highways

(*Continued from page* 15)

ing and sodding. However, soon after the war started, planting was greatly curtailed and little is now being done except necessary mulch-seeding and sodding.

Fortunately, Maryland never did any extensive planting which requires excessive maintenance. Because of the manpower shortage, some states are now finding it very difficult to maintain plantings of this nature. Roadside development should be carried on with one thought in mind, and that is to effect a reduction in maintenance, to stop entirely the necessity for clearing roadways and drainage systems of eroded soils which wash in from bare and unsightly roadsides after every heavy rainfall. This erosion not only caused great damage to our highways and their appurtenances, but was a potential hazard to traffic as well. With the quick establishment of vegetative ground covers, the necessity for this type of highway maintenance is eliminated.

Need for Equipment

However, with the grass-seeding of park and flat areas, another type of maintenance is required, and that is mowing. This need will become greater as park-area mileage is increased, and we feel that present equipment is inadequate and unsuited to quick and efficient highway mowing.

Roadside development departments are in the market for equipment especially designed for their work, such as time and money-saving mulch-seeding spraying equipment capable of covering inaccessible areas quickly and efficiently, for especially designed equipment for loosening and applying topsoil to slope areas, and particularly for a rotary mower capable of mowing at speeds up to 20 miles an hour and with easy maneuverability for trimming around group plantings, posts, trees, and other obstructions.

Such a mower should be so designed that its rotaries are located just ahead of the operator in order that he may observe his work at a glance and maneuver the mower quickly and correctly. The rotaries should be in three sections and extend from both sides and under the tractor, and the sections should be separate and individually controlled by the touch of a pedal or pedals. This feature would permit the operator to lift the right or left or both rotary sections when necessary to work between close objects. If practical, the rotary units should be operated by tractor power instead of the present individual traction type. Extra rotary sections could be kept in repair and a quick change of sections could be made very simply. The main feature of this mower should be its ability to mow at high speed on open park areas.

With the Federal government's promise of aid in the construction of 300-foot-wide freeways and parkways after the war, better and faster mowing equipment, especially designed for highway work, will be urgently needed to keep these areas in proper condition. The American ingenuity which is now producing the best war equipment in the world should have no difficulty in producing the best equipment for peace and pleasure.

Post-War Roadside Plans

With the curtailment of all new or additional plantings for the duration of the war, with the exception of mulch-seeding for erosion control, comes an opportunity to work on plans and specifications for a post-war program of roadside development. The Maryland State Roads Commission was instrumental in having passed by the 1941 Legislature a bill entitled "Freeways", which gives the Commission authority to designate, construct and regulate freeways, and to plan now for freeway construction.

Most of our post-war planning is now in the conference stage. A large program is under consideration and, although tentative, it includes a freeway through Baltimore City, either by way of a bridge over Baltimore City Harbor or through the center of the city or both. In addition to plans for building multiple and dual highways through western and southern Maryland and along the Eastern Shore, there is also a tentative plan for the construction of a super-highway extending from the northeastern border of the state through Baltimore to the nation's capital. The design and location of these highways have not been fully decided as yet, but there is every indication that landscaping will be done on all in accordance with their importance, and that the Roadside Development Department will have a very important part in their location and design. The public naturally expects that these highways, and especially the freeways, be comprehensively landscaped and that their location will take full advantage of desirable

(*Concluded on next page*)

ARBA Reveals Lack Of Post-War Plans

In the absence of concrete plans in the form of blueprints, right-of-way acquisition, et cetera, the possibility of post-war public relief instead of post-war public works is pointed out by Carl W. Brown, President of the American Road Builders' Association and Chief Highway Engineer of Missouri, in announcing results of surveys made by the Association. According to these surveys, there is a general lag on the part of state and local governments in taking the necessary preparatory steps now, so that public works construction plans can be put into execution immediately at the end of the war. Although highway construction plans hold a substantial lead over other types of public construction, Mr. Brown said, nevertheless highway agencies admit they are far behind in establishing a backlog of projects in readiness for the post-war era.

In speaking of the seriousness of the situation, Mr. Brown said: "While everyone hopes that business and industry can meet post-war job requirements, common sense warns that insurance should be taken out in the form of advance public works planning. According to recent authoritative estimates, there will be from nine to ten million more men and women seeking work than there will be jobs. During the last depression, relief work as typified through WPA soaked up more money than was spent for planned public works projects of a substantial and lasting character.

"Unless there is an ample supply of public works projects designed and ready to go immediately after the war's conclusion; another WPA will threaten. Relief work is not what the men in uniform have in mind as a reward for their service."

Lack of active local interest, the manpower shortage, and delay by the Federal Government in making known its plans on such matters as Federal highway aid, are among the reasons cited by Mr. Brown for the lack of post-war preparedness.

New Post-War Guide For Equipment Buying

Every post-war construction-equipment buyer must ask himself five pertinent "pocketbook" questions, according to "A Guide for Your Post-War Equipment Buying" just made available by R. G. LeTourneau, Inc., Peoria, Ill. These questions are concerned with the experience and knowledge of the manufacturer, past performance of the machines, and end with "Will it make money for me?".

The profusely fact-illustrated booklet answers each question as far as LeTourneau equipment is concerned, by quoting the record number of LeTourneau products manufactured in the past decade, by presenting job notes and photos representative of 252 fleet owners in all forty-eight states, and by other pertinent information on LeTourneau personnel and performance.

Free copies of this brochure, Form G-1060, may be secured direct from the company. Just mention this item.

Wherever possible, valuable trees are preserved along Maryland's roads.

Future Roadside Work Planned by Maryland

(*Continued from preceding page*)

and interesting landscape features.

In the development of plans for highways in western Maryland, the construction program has to some extent been definitely decided and in two or three instances work has already been started and is to be completed after the war. Plans include the location of many desirable places with potentialities for development into safe off-the-road parking areas, picnic grounds, and scenic overlooks. We are also planning the standardization of all signs directing motorists to the landscape features, including the State parks, which are supervised by the Department of Forests and Parks, and with which agency the Roadside Development Department works very closely. On most of the State Roads Commission's post-war planning trips and also in our conferences, we have called in a representative of the Department of Forests and Parks because of our mutual interests. As a result, we have included in our plans much more that will benefit the public, the most important of which will provide a safe and adequate linking of Maryland state parks with our highway system.

Aerial photographs have in the past been used by the Commission mostly for the purpose of selecting economical highway locations. However, in the future, aerial photographs will play a great part in selecting, as far as is practicable, freeway locations providing the most interesting landscape features available, all for and in the interest of the traveling public.

Conservation Welding

An informative illustrated bulletin called "Conservation Welding," which contains helpful suggestions for reclaiming worn equipment which must of necessity be kept in use as long as possible, has been made available by the American Manganese Steel Division of the American Brake Shoe Co. The welding operations described include the repair of tractor sprockets, clamshell-bucket teeth, manganese-steel rock hammers, crusher-liner segments, conveyor screws and many others, based on actual reports of such salvaging work received by the company. The bulletin was prepared on the theory that, while in peacetime it is often considered more economical to scrap worn parts, during the present emergency the conservation of metal is an important part of the war effort and welding offers a practical solution when new metal parts are difficult or impossible to secure.

Copies of Bulletin 344-W may be secured upon application direct to the company at 398 E. 14th St., Chicago Heights, Ill. Just mention this review.

The new single-cable-controlled hauling scoop recently announced by the Southwest Welding & Mfg. Co.

New Dirt Scoop Has Single Cable Control

One of the features of the new two-wheel rear-dump hauling scoop made by the Southwest Welding & Mfg. Co., 3201 West Mission Road, Alhambra, Calif., is the single cable control. This scoop embodies a new principle in hauling scraper design, the manufacturer reports.

The cutting edge is "sucked" into the ground, the dirt flowing freely into the specially designed bowl which pivots behind the wheel to permit over-bank dumping when necessary. The load can be dumped while moving forward, backward or standing still, and the spreading depth is under the control of the operator at all times. Maximum ground clearance prevents hanging up when hauling over uneven terrain and a low center of gravity is designed to prevent overturning, even on steep grades.

The Southwest hauling scoop is made in 3, 5 and 8-cubic-yard capacities, for use with 25 to 35-hp, 40 to 55-hp, and 60 to 75-hp tractors, respectively, and the manufacturer states that its accurate line-of-plate struck measure provides a dependable basis for calculating actual loads. The widths of cut vary from 4 to 6 feet, and the digging depth, below the rubber tires, is 7 inches for the 3 and 5-yard models and 10 inches for the 8-yard scoop.

A 4-page folder on this Southwest hauling scoop may be secured by interested contractors and state, county and township highway engineers direct from the manufacturer, which makes a line of construction equipment including bulldozers, trailbuilders, dirt-moving scrapers, power control units, tampers, rippers, cranes, brush cutters, and dump bodies. Just mention CONTRACTORS AND ENGINEERS MONTHLY.

Indeterminate Structures, Their Analysis and Design

A new presentation "Indeterminate Structures" has been written in a simple brief manner by Fred L. Plummer, Chief Research Engineer, Hammond Iron Works, Warren, Pa., formerly a professor of structural analysis and design in undergraduate and graduate courses at Case School of Applied Science. While prepared for teaching, this book is a valuable tool for all structural engineers because of its wide scope. It will prove helpful to those who must check the designs of others who may have used unfamiliar analytical methods.

The new volume is published by Pitman Publishing Corp., of New York and Chicago. Price $4.00.

Dust Control Devices Now Made by Carter Co.

The Ralph B. Carter Co., Hackensack, N. J., pump manufacturer, announces the creation of a Dust Collector Division, having taken over the line of dust-control equipment previously manufactured by the Markley Dust Control System, Inc. This equipment, designed for controlling the dust problem on rock drilling and similar construction jobs, is fully described in a new catalog. To secure copies, write to the company for Bulletin 4402.

A New Cross-Cut Saw Driven Pneumatically

Because of the demand for a pneumatic saw intermediate between the 15 and 24-inch models made by the Davey Compressor Co., Kent, Ohio, this company has developed an 18-inch saw which, like its other models, can be used above or under water.

The manufacturer states that these saws have done much to help solve manpower problems of contractors since they enable two men to do the work formerly requiring six or eight on timber-cutting jobs. At 225 strikes per minute, the saw can cut an 18-inch timber in less than one minute. The operator does not have to support the weight of the saw because an easily operated clamping device carries the weight, preventing arm-jerking jolts and uneven cuts.

Complete information concerning these three sizes of Davey pneumatically driven cross-cut saws may be secured direct from the manufacturer by mentioning this item.

Quick Easy Erection Of New Steel Hangar

A Minimum of Equipment Is Required to Assemble and Erect Light-Weight Arches At Washington Airport

(*Photo on page* 88)

✦ ACCIDENTAL release and falling of a 7-ton steel arch ring when a winch on a truck slipped out of gear demonstrated the advantages of a new hangar design at the Washington, D.C., National Airport. The arch fell through a distance of about 45 feet, landing on the light timber cribbing on which it had been assembled in a horizontal position. Although nine of the sixteen arch segments were badly bent, the arch was unbolted, and all parts, except a few lattice struts, were straightened on the job, and then reassembled.

This steel hangar was being erected for the Air Transport Command. The hangar and lean-tos are intended for all local maintenance and service operations of the A. T. C. Designed by the engineers of The American Rolling Mill Co., Middletown, Ohio, at the request of the U. S. Engineers and in the interests of saving steel and other critical war materials, this hangar employs light-weight pressed (as against hot rolled) structural members. Similar structural units have long been employed in light-weight trusses for industrial buildings in the South. When bolted together, these units have maximum strength with minimum weight.

A trial installation of a somewhat smaller steel hangar was made at Camp Springs, Maryland, by the U. S. Army Engineers in the spring of 1943. Later this hangar was dismantled and moved to Florida where it now serves the Army Air Forces.

The Washington Hangar

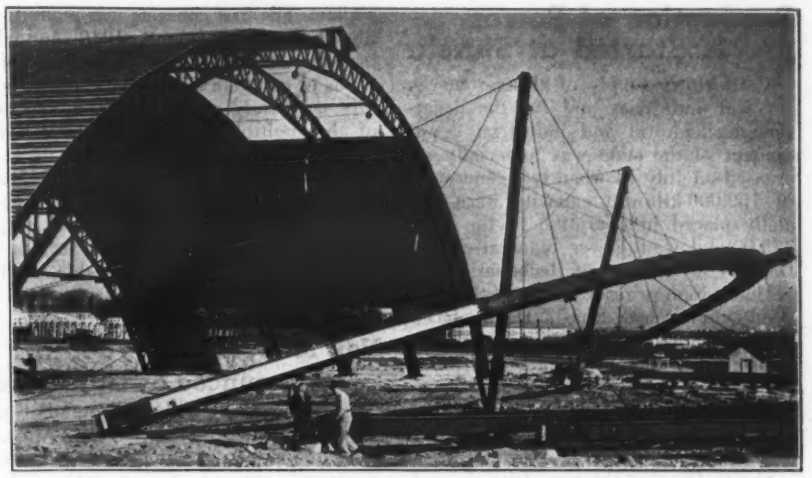
The overall inside dimensions of the hangar proper at the Washington Airport are 192 feet wide, 48 feet high, and approximately 200 feet long. There are eleven bays on 17-foot 4½-inch centers. Lean-tos have been added at each side to serve as shops and offices. These extend about 5 feet beyond the base of the hangar proper and are about 15 feet high. The effect is that of a rectangular structure, 26 feet wide. A monitor for ventilation purposes surmounts the ridge of the hangar.

The west end of the hangar is covered with fixed door leaves, whereas the east end is provided with a new type of door leaf supported on a single rail at the bottom. These leaves are of Steelox panels in a heavy metal surround, 10½ feet wide x 20 feet high, and are automatically switched off the main rail and stacked parallel to each other in a door storage tower at each corner.

Foundation

Bearing tests made near the northwest corner of the airport, west of a principal runway, showed that the silt and muck that had been pumped in to make the airport was somewhat unstable. This necessitated relocating the hangar so that part of it occupies a portion of the automobile parking area.

In addition, part of the soil at the east end of the hangar had to be removed and replaced with a timber mat, covered with a stabilized base of gravel for the 8-inch concrete floor of the hangar. Although the corrugated base plates, 3 x 6 feet in area, which support the arches are ample to be placed directly on any reasonably firm soil capable of furnishing a bearing of 3,000 pounds per square foot, it was considered advisable to build concrete footings 4 x 7 feet and from 2½ to 6 feet deep.



The arch rings for a new steel hangar at the Washington National Airport were erected by means of a double hitch over two gin poles to a winch truck.

Two lines of storm sewer cross under the hangar, emptying into a 15-inch line along the north side which connects with

(*Concluded on page* 79)

Production of Power Is Started at Shasta

California's supply of electric energy for war industries and for the peacetime agricultural and industrial development of the state was materially increased on July 14 when two generators of 150,000-kilowatt capacity were officially placed in operation in the huge 375,000-kilowatt power plant at Shasta Dam by the Bureau of Reclamation.

Under high-priority orders of the War Production Board, Shasta Dam, Shasta Power Plant, and the Shasta-Oroville transmission line are being rushed to completion on an emergency construction program to insure an adequate supply of electric energy for California war industries.

Shasta Dam, at the top of its class of public works in size and contribution to the welfare of the state and the nation, has for months regulated releases of stored water into the Sacramento River on a schedule determined by the overall needs of the farmers in the Sacramento Valley. The first concrete was poured in Shasta Dam on July 8, 1940, and although not all of the 6,500,000 cubic yards of concrete are in place, the structure is already at work serving several of the multiple purposes for which it was designed.

The Bureau of Reclamation had planned a formal ceremony to start the production of electric power at the project but, owing to the fact that Secretary of the Interior Ickes was unable to attend, the ceremony was cancelled.

New Manufacturing Set-Up Announced by Gar Wood

Glen A. Bassett, President of Gar Wood Industries, Inc., Detroit, Mich., has announced a reorganization of the company's manufacturing set-up designed both to ease the transition to post-war manufacturing and also to improve even further its output for the Army and Navy. The principal changes involve the creation of the post of vice president in charge of manufacturing and the establishment of a production control manager and a general superintendent of the mechanical division.

Clinton W. Wood, formerly Vice President and Manager of Gar Wood Industries' Plant No. 4, has been named Vice President in charge of manufacturing. Alonzo R. Ketcham, formerly Production Manager of winch war contracts, will serve as Production Control Manager and will be responsible for personnel management, machine and departmental scheduling of product manufacturing. Henry Kvindlog has been made General Superintendent of the mechanical division.

Avoid Legal Pitfalls

These brief abstracts of court decisions may aid you. Local ordinances or state laws may alter conditions in your community. If in doubt consult your own attorney.

Edited by A. L. H. STREET, Attorney-at-Law.

Contractors Not Bound To Make Separate Survey

When highway engineers mark a line on the ground as the center line of a proposed road, a bidding contractor is not bound to check the line against the plans by conducting an independent survey, when there is nothing to indicate any probability of error.

The gentlemen who strung strips of red cloth on trees to mark the center line of a New York highway wandered so far from the straight and narrow way as to depart 11 feet at the terminal stations and 129 feet at the middle section from the line shown by the plans. (The section covered 2 or more miles of bosky and rocky terrain.)

Work had progressed for a month when the state engineer discovered that the road had jumped the track, and ordered construction along the correct line. That involved added cost of doing the work, for which the Court of Claims for New York ordered judgement in the contractor's favor. (Rizzuto v. State, 44 N. Y. Supp. 2d, 40.) Said the Court in its decision:

"It is only where uncertainty as to existing physical conditions is indicated that a contractor is bound to satisfy himself as to existing conditions or suffer the penalties imposed by the contract terms for such failure.

* * *

"Here there was no uncertainty. The center line of the route was distinctly marked, and for the sole purpose of aiding a bidder in making his examination of the site. There was no occasion for the claimants to suspect that the State engineer had marked the route otherwise than in accordance with the approved plans. *The center line of the new highway as designated and marked by the State in the field constituted a material representation upon which the claimants relied,* and which induced them into making the estimate and proposal which became the basis of the contract. While the mistake in improperly marking the center line of the new highway resulted from negligence, and while such circumstances in the absence of knowledge or concealment does not take on the complexion of active fraud, it was nevertheless a falsity, and so material that when relied upon it amounted to breach of contract."

But the Court decided that the contractors were not entitled to reimbursement against damages paid to the owners of houses near the actual site on account of blasting operations, carried on after correction of the mistake in locating the highway brought the work close to those houses. The contract required the contractors to carry insurance against such damage claims, and they had ample time, after discovery of the mistake and before the blasting was done, to secure such insurance.

Gravel Contract Goes Through Judicial Hopper

Just what was meant by the following clause in a contract-letter sent by the operator of gravel-loading equipment to the owner of a pit was a problem decided by the Louisiana Court of Appeals in the case of Vaughan v. P. J. McInerney & Co., 12 So. 2d 516:

"You agree to furnish sufficient trucks and all other hauling facilities necessary so that the dragline may operate at a *minimum of 80 cubic yards per hour* when working *and* that the *minimum yardage* to be loaded by the machine *in any given month* shall be 10,000 cubic yards."

Question arose, in an action for damages against the pit owner for failure to provide sufficient trucks to move the gravel, whether he was in the clear if he provided enough trucks to move 10,000 yards per month, although he did not provide enough to take care of the hourly minimum specified. Deciding that it was necessary to furnish enough trucks to fulfill both the hourly and the monthly minimum movement of gravel, the court said:

"If the sole obligation of defendant was to assure a certain monthly volume, the hourly rate of operation could have no import and any provision affecting such hourly rate was meaningless. We cannot find any justification for a contention which would relieve defendant of the plain duty of furnishing sufficient facilities to permit a minimum hourly rate of operation by plaintiff's machine."

Responsibility for Injuries To Trespassing Youngsters

A construction company was not liable for the death of a nine-year-old boy who went into a sand pit on the company's premises to play. The pit was 100 feet long, 50 feet wide and 10 feet deep, with perpendicular walls. The boy was killed in a cave-in.

The lawyer for the boy's father attempted to fix liability upon the construction company under what is known as the "attractive nuisance" rule. That rule applies to the creation of dangerous conditions which naturally tempt children of immature years, (for example, where a contractor leaves equipment in a street in such condition that youthful pranksters can easily move it to their own peril). The Illinois Appellate Court ruled that the company was not liable. (Anderson v. Reith-Riley Construction Co., 44 N. E. 2nd, 184.)

The court draws an analogy between cliffs and embankments created by nature, and those artificially created by contractors. It is inferred that, along with their A B C's, youngsters learn of the perils of playing in such places. The court concludes:

"If the owner of private property, by excavating on his own property, creates an artificial cliff or embankment, merely duplicating the work of nature without adding any new dangers, and a child, without invitation, ventures on the private property, excavates below the surface and is injured or killed by a resultant cave-in, the owner is not liable because of having created an 'attractive nuisance'."

Court Blasts Blaster

Old Man Law declares that, if any one does anything that is apt to hurt someone else, liability follows even though the precise consequences were not actually foreseen. The pioneer court decision on this subject is known as the Squib Case, which originated in England away back in the dim past. There defendant threw a squib (firecracker) at a third person who, in instinctive self-defense threw it away from himself before it exploded, resulting in the plaintiff being injured. The court decided that the defendant was liable to the plaintiff although he did not intend that the squib explode near the plaintiff.

The same principle was recently applied by the Texas Supreme Court in a case that is remindful of an old nursery rhyme and some stories about successive consequences.

In the Texas case, Uvalde Construction Co. v. Hill, 175 S. W. 2d, 247, the appellant construction company conducted blasting operations in a highway. One blast was violent enough to frighten a cow, almost a half mile away, that was being milked by Mrs. Hill. Bossy bounded against Mrs. Hill, bowled her over and trampled on her. The court decided that the construction company was liable to the injured woman. In short, the company was bound to know that there was apt to be a cow close enough to the place of blasting to become violently agitated by something which she probably could not distinguish from an earthquake. The company was also bound to know that it is customary for people to milk cows, and that a frightened cow would imperil any one who happened at the moment to be extracting lactic fluid from her.

Preparing Airfields For Sodding Operations

(*Continued from page 24*)

that the sod will be level with the concrete after it is watered and rolled. No portion of the sod should extend above the concrete. On the other hand, placing the sod even an inch below the concrete creates a hazard, for the safety of the planes must be considered. The rubber tire of the landing gear may be cut on the edge of the concrete if sod is placed below the level of the concrete.

Experience has shown that the propeller slip-stream of planes standing within 25 feet of the edge of an apron or runway produces a blast sufficiently strong to peel up sod like a sheet of paper if it can strike under the surface of the sod. Only long strips of sod, 3 to 4 feet, and only if placed level with the edge of the concrete, will withstand the tremendous blast of the propeller slip-stream. The author has seen sections of sod 1½ x 2 feet and 2 inches thick lifted out of place and carried 50 feet by such blasts, after the sod had been rolled but was still ½ inch above the concrete. Carelessness in laying the sod at the edge of the concrete is likely to result in costly and annoying replacements.

Preparation of the Areas

Specifications are becoming more and more standardized in the requirements for the preparation of soil in sodding work. However, very often it is left to the judgement and choice of the engineer and/or inspector in charge of operations. In the absence of explicit directions, it is safe to assume that the same practices which are specified or required for "Seeding Methods" or "Seeding Construction" (See C. & E. M., May, 1944, page 11) will be required for the soil preparation before the sod is placed.

Typical specifications for soil preparation provide for the following items, taken from recent specifications of the Civil Aeronautics Administration:

1. Spreading of the fertilizer and incorporating it with the soil at least 24 hours before the sod is placed.
2. Disking to a depth of at least 2 inches.
3. Surface harrowing until smooth, fine and free from debris, clods, stones, etc., and as approved by the Officer in Charge.
4. Final cultivation not earlier than 24 hours before the sod is placed.
5. If, as a result of rain, a crust is formed over the prepared surface, the surface shall again be placed in a suitable condition.

Occasionally, specifications provide that the sod bed shall be watered by approved means, should the contracting officer so direct. If watering is necessary, it is better practice to soak the sod bed thoroughly immediately after the sod is placed.

Soil preparation must of necessity vary, depending upon the type of soil. In a loose sandy loam, ordinary dragging and smoothing is sufficient. With a very heavy clay, double or treble disking is often required. Some inspectors insist there be no trucking or tramping over the soil after final cultivation or just before the sod is laid. Others are very lenient. Obviously, any tramping or trucking over the area after cultivation creates a condition adverse to new root growth; hence it should be avoided.

Fertilizing the Sod Bed

Where fertilization is used beneath the sod, specifications again differ. Some require a time interval of 24 hours between the spread of the fertilizer and the placing of the sod. If disking is required, it is well to spread the fertilizer before the disking takes place. Most inorganic fertilizers are likely to be toxic to the freshly cut roots. It is always a safe practice to spread the fertilizer well in advance of the sod-placing operations.

Highly soluble plant nutrients in a fertilizer, like nitrogen, and potash compounds, may be applied on the sod after it is placed and carried into the soil in the watering operations. If the fertilizer is not washed into the soil soon after application, there may result a burning of the grass or roots. With light applications of 300 to 500 pounds per acre, the toxic effect by either method of application is negligible. Where the specifications call for an application of 1,000 to 1,500 pounds per acre, greater care is necessary in applying the fertilizer in order to avoid root and grass injury. If the fertilizer contains a high percentage (12 to 16 per cent) of phosphorus, it should be well incorporated into the soil. Disking after the fertilizer is spread is essential because available phosphorus as a nutrient loses much of its value unless placed in the immediate region of root growth.

A factor which is very important, and frequently overlooked, is the timing of the application of the fertilizer in relation to possible slip-stream action. If the field is being used by planes, the application of the fertilizer must be timed so that the fertilizer will not be blown from the area by the action of a propeller before the sod is placed. This is important regardless of the rate of application of the fertilizer. When such conditions are encountered, it is safe to apply the fertilizer just before watering the sod.

The basic elements in a fertilizer analysis are always given in the same order. In a fertilizer analyzing 4-10-6, 10-16-4 or 4-12-4 the first figure is the percentage of nitrogen, the second phosphorus, and the third potash.

(*Continued on next page*)

Selection and Cutting Of Sod Are Important

(*Continued from preceding page*)

The following rules, although more or less arbitrary, should prove helpful:

1. Light applications of 800 pounds per acre or less may be made before disking, after disking, or after the sod is placed, provided it is washed well into the soil.
2. Inorganic fertilizer, high in phosphorus, should always be well incorporated in the soil by deep disking regardless of the rate of application.
3. At all times, avoid having the fertilizer "scattered to the wind" by the slip-stream from the propeller of nearby planes.
4. Organic fertilizer, like bonemeal, bloodmeal, wood ashes, or cottonseed meal, are not likely to have a toxic effect on the roots and should be worked lightly into the soil, for all are slowly available, light in weight, and easily blown away.

Buying Sod

Sod is usually purchased by the acre and measured in one of two ways. The prevalent system is to measure the acreage at the field where the sod is cut, the contractor taking the loss between the sod which is laid and the sod which is purchased. A more satisfactory way, from the contractor's point of view, is to measure the sod on the site where it is laid. There is a 25 or 35 per cent shrinkage between the area where the sod is cut and the area where it is laid. This shrinkage is not exactly predictable, as it may be due to several factors: presence of white grub, unusual variation of the soil, mole injury, cow droppings, or shrubby plant roots like wild roses or seedling thornapple which cause sod to be discarded. Measuring the sod in the field is most satisfactory for the farmer because he can easily check the measurements and determine the acreage of the sod sold.

Extensive areas for purchase are not often available. On one airport job of 40,000 square yards, the sod was purchased from six different farmers in order to have a haul of 5 miles or less. The only single tract available necessitated a haul of 14 miles. The price paid to the farmers for the privilege of removing the sod varies from $50 to $200 per acre, depending upon where it is measured, the quality of sod, and the local supply and demand. In metropolitan areas or near large housing projects, the sod available for purchase is often limited because the supply has been exhausted. Payment to the farmer is usually arranged as follows: $50 down payment with an informal letter of agreement (most farmers are skittish about legal forms) and additional payments as sod is cut.

Where the sod is furnished by the using agency, namely, taken from the site, the requirements for the quality of the sod are seldom exacting. The best sod available is the sod which is used. If it is to be furnished by the contractor, many factors must be considered. To the using agency, the quality of the sod is the important item. To the sodding engineer, the ease of cutting and the distance of hauling are of prime importance. Good sod and efficient cutting are the important items in sodding, for any delay or sluggishness in the cutting will result in a bottleneck for the entire project.

Sod Conditions and Cutting

There are some unpredictable factors which add to the cost of sod. The water content of the soil determines whether watering the sod before cutting is necessary. In extremely dry weather, much time can be saved in the cutting and placing operations if the sod is watered 8 to 10 hours before it is cut. The length of the grass is always a factor. Some cutters will cut sod regardless of the length of the grass, while others will not operate well unless the grass is fairly short. This often makes it necessary to cut the grass before cutting the sod. Long grass is an advantage if the sod is laid in late autumn, as it acts as a mulch, preventing the frost from entering the ground and providing a longer growing period before winter sets in after the sod is laid. This is an advantage at both ends of the job for the sod can be cut early in the morning even after frosty nights. Very short grass usually should be avoided, for grass which has been close cropped, as in a pasture, is quite certain to have a shallow root system. Short-cropped grass is almost always weedy and infested with white grub. The ideal length of grass for sodding on airports, in both cutting and placing operations, is 2 to 3 inches. Weedy, stony, or sandy soil in sod-cutting areas should always be avoided. Sloping sites on wet days are apt to give trouble and cause the sod cutter to skid or slip.

Specifications vary regarding the requirements of sod thickness at the time of cutting. The common thickness specified is usually 2 inches, although 1 inch has been known to give excellent results. The thickness depends upon the kind of grass present and the nature of the soil, and is usually measured by laying three strips of sod on top of each other, soil side down. The center piece is then measured from the bottom edge of the soil on the top strip to the bottom edge of the center strip.

The type of cutter to be used, the nature of the soil, and the terrain, the proximity of the road, and the length of the haul are all important factors to be

(*Continued on page* 53)

Jungle Road Built By Army Engineers

Work of Americal Div. On Bougainville Record Of American Stamina and Engineering Skill

AFTER the successful American counterattack on Bougainville's Hill 260 had sent the Japs reeling back into the jungles east of the Torokina River on that Pacific Island, a large order was laid before Major John E. Rowan, of Lexington, Mass., and his Engineers in the Americal Division. At that time, the Torokina had been spanned by only a flimsy footbridge. Beyond lay thick matted jungle, towering trees, swamps, sharp ridges and deep valleys. Though the enemy had been chased from the area, there was a strong probability of snipers infiltrating and trying to knock off Americal Engineers. In the face of these conditions, the order was to build a two-lane highway behind advancing infantrymen.

Bridging the Torokina

The first major hurdle was the Torokina itself, a typical jungle river, fast-flowing, high-banked, with the ability to rise several feet in an hour and of shifting its streambed on equally short notice. Piling had been sunk on the American side when the Japs were still taking pot shots from across the river. The piles were located some distance upstream from where the map indicated the river should be bridged, but they had to be placed where high banks forced the Torokina to remain in its original channel.

U. S. Engineers Photo

Combat Engineers of the Americal Division are shown rushing construction of a bridge across the vital Torokina River on Bougainville. Now completed, the bridge serves vehicle and foot traffic into territory held for many months by the Japanese.

Major Rowan's men had won two citations for outstanding engineering feats during the Guadalcanal campaign, but this projected road dwarfed anything they had tackled yet. Time was precious. In order to keep hitting the enemy before he had time to dig in, the Infantry had to have a steady flow of supplies.

Piles were driven to support 40-foot spans and stones piled around them to prevent undermining by the swift current. Huge mahogany logs were towed into place, spanning the gap between piles. Although work went on rain or shine, the torrential showers made the river boil with high water, hampering operations.

Meanwhile, the portable sawmill was turning out lumber, largely mahogany, worth thousands of dollars in the States but on Bougainville used for latrines, tables, and bridges. Planks from the sawmill were spiked into place over the logs, and there was Torokina Bridge, 313 feet long, wide and sturdy enough for the largest vehicles, and completed in five days after the first sledge-hammer blows on the piling.

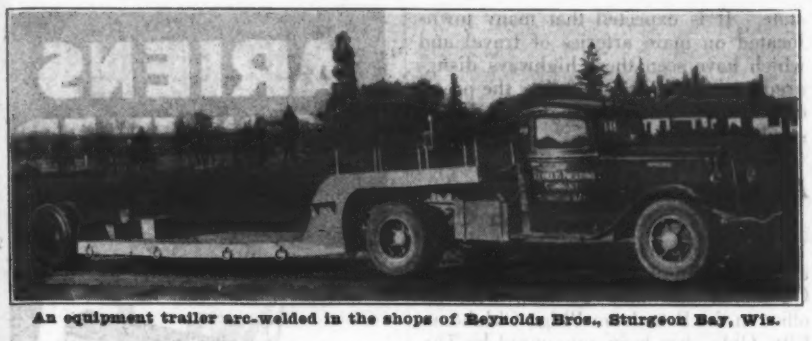
Cutting Through a Road

Previously, heavy-duty crawler tractors manned by Army Engineers had forded the stream. While the Infantry sent security patrols into the local jungle, bulldozers dove headlong into the tangled undergrowth, backed off, and made another rush. A good "cat" operator was invaluable on this island; he determined where the road would bend and where it would go straight through. Among the men operating these units was T/4 Charles E. Manion of Acton, Mass., who used to demonstrate for the Allis-Chalmers Mfg. Co. back home, and who is reported to be one of the best "cat" operators in the business.

Armor plate was placed around the tractor seats of these outfits as a protection to the operators against sniper bullets. In addition, infantrymen were stationed in the area or patrolled the trail ahead. Half-tracks, mounting machine guns, had stations nearby and on the American side of the Torokina were tanks, dispersed in the underbrush.

Behind the bulldozers, trucks built up the roadbed with sand. The first pit was in the Americal area, where two gasoline-powered shovels were constantly at work. Trees and stumps plagued the shovel operators. Twice in one day, the bolts holding the shovel boom were sheared off when the dipper banged into a neighboring tree. However, on the spot was a portable machine shop, ready

(*Concluded on page* 85)



An equipment trailer arc-welded in the shops of Reynolds Bros., Sturgeon Bay, Wis.

Arc-Welded Trailer For Moving Tractor

For several years, Reynolds Brothers of Sturgeon Bay, Wis., have hauled their large tractor with bulldozer attachment on a large semi-trailer flat rack, whenever their work was to be carried on some distance from their headquarters. While the tractor was not so heavy, only 7½ tons, it was difficult and dangerous to load with planks and blocking. Last winter, one of the drivers dumped the tractor off the trailer and it took a wrecking crew one-half day to untangle the wreckage, and two men one week to repair the damage to the tractor and truck.

Right then, Reynolds Brothers decided to look around for available materials to build a trailer suitable for their needs, which would eliminate the hazards of loading the tractor and would prevent a similar occurrence to their equipment. After dreaming a few nights and looking around during the day, they located an old dump truck with a good heavy frame, which they bought for $30, and, with two heavy rear ends, two old motors and various thicknesses of plate, they started to build an 8 x 25-foot overall trailer in their own shop which measures only 20 x 30 feet. The underslung bed of the trailer is 8 x 14 feet, with a ground clearance of 10 inches.

All welding was positioned on a frame by revolving the work, similar to a fish-net reel. The frames were made tubular instead of just channel, and the four main beams are of 3 x 7-inch tube. The cross frames are of 2½ x 6-inch tubes, alternating with 2½ x 6-inch tees made from plate. To get the rise to the fifth wheel, the gooseneck was made of two arched tubes 8 inches x 4 inches x 8 feet, and was gusseted throughout to keep it from buckling. Whenever strength was doubted, 7/16-inch fish plates were added and concealed in the tubes and arches. The various plates used were ¼-inch, 3/16-inch, 5/16-inch and in a few places 7/16-inch. Deck plates were made by spotting floor-plate design on common smooth plates with 3/16-inch welding rod. Air booster brakes were built in complete. The fifth-wheel pin is of standard size to fit any tractor wheel lock and was made on their shop lathe from a 4-inch drill jaw and welded into the frame of the tractor with gussets.

The barrel deck, which is used for fuel oil, has standards of old pipe with a chain railing; steps to the barrel deck were welded on each side, and an emergency jacking shelf is all-welded to the gooseneck. The trailer complete weighs 5,945 pounds, and the necessary loading equipment consists of two blocks of wood to raise the front of the tracks so that the tractor can crawl on to the trailer.

The trailer was completed in three weeks by one welder and a helper, and cost approximately $600. Although built to haul 8 tons, it has since hauled 15-ton loads, consisting of two tractors loaded crosswise. Where it formerly required two men at least two hours to load, haul 5 miles, unload and return, with the new trailer this can be accomplished in one hour with one man and with much greater safety than before, Mr. Reynolds reported.

This report on a shop-built equipment trailer was submitted by Fred Reynolds of Reynolds Brothers in the Arc Welding News Contest conducted by Hobart Bros., Troy, Ohio, manufacturer of arc welding equipment.

Tarvia for Road Work

The use of Tarvia and Tarvia-Lithic in road construction and maintenance is discussed in considerable detail in an 8-page booklet issued by The Barrett Division, Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y. Patching, widening, surface treatment and resurfacing are treated on separate pages, with specific recommendations for the use of one or more Tarvia products. Illustrations supplement the text.

Copies of this booklet, "Tarvia and Tarvia-Lithic", as well as the Barrett Tarvia Manual which contains definite methods of use and standard specifications, may be secured by writing direct to the manufacturer. Just mention this item.

Billboard Control In Springfield, Vt.

At a recent Town Meeting, the Town of Springfield, Vt., unanimously passed a measure prohibiting all advertising signs having an area of over 40 square feet, excepting business signs on property which pertain exclusively to the property itself, its sale, its rental, or business conducted thereon.

This Town action finds its authority in the recent decision of the Vermont Supreme Court which, in upholding the state billboard law, declared that billboards have no inherent right to use the highways for advertising purposes. Pointing out that billboards are essentially a use not of private property but of the public thoroughfare, the Court declared that if a state or municipality enacts a law restricting, or even forbidding, highway advertising, neither the property owner nor the billboard owner would be deprived of any constitutional rights.

This opinion from a State Supreme Court gives a new angle to the matter of billboard restriction, and in Vermont gives complete local option to cities, towns, and villages, which may enact their own laws for the protection of their roadsides and streets from disfiguring commercial advertising. The Town of Springfield is the first to take advantage of the power granted.

At one time the Town of Springfield had seven large posterboards, each measuring 300 square feet and all in scenic locations, three with the Connecticut River as a background. The removal of these was achieved by a constant stream of protesting letters from Springfield citizens to the business firms advertising on the billboards. The measure adopted at the Town Meeting will now prevent the erection of any more such billboards in Springfield.

The Vermont Association for Billboard Restriction, affiliated with the National Roadside Council, was responsible for the passage of the state billboard law which has already proved one of the most effective enacted by any state. It is expected that many towns located on main arteries of travel and which have seen these highways disfigured by billboards will follow the precedent established by Springfield and take similar action.

Asphalt Institute Opens Office in Oklahoma City

The appointment of A. J. Kavanaugh as District Engineer for the territory of Oklahoma and New Mexico, with an office in the Petroleum Bldg., Oklahoma City, Okla., has been announced by The Asphalt Institute. Mr. Kavanaugh's engineering experience includes designing and construction work in Oklahoma during the past thirteen years and five years' service as Secretary-Manager of the Oklahoma Good Roads Association. In opening the Oklahoma City office, the Institute states that it is now equipped to extend its engineering, research and promotional facilities to highway engineers and contractors more intensively in that area.

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A Drainage Program That Pays Dividends

Subdrainage Has Ended the Annual Epidemic of Frost Boils on Connecticut Roads; Surface-Care Cost Reduced

✦ In 1940, the Connecticut State Highway Department instituted a program of subsurface drainage (C.&E.M., Oct., 1940, pg. 17) to prevent the annual spring break-up of such important cross-state thoroughfares as U. S. 44 and U. S. 6 which have light bituminous surfaces. The success attending these installations is evidenced by a recent inspection covering many sections which had been "bad actors". The asphalt-coated corrugated-metal pipe has removed all subsurface water which weakened the base, and the corrugated-metal manholes have functioned as expected, although they have not yet been used for cleaning the subsurface pipe as it has shown no signs of clogging.

Of paramount value in these war days of lack of materials and man-power has been the almost complete elimination of break-up of pavement surfaces, all but two of which have retained their integrity and not required repaving since the installation of subsurface drainage and greater care in the preparation of paved gutter sections on grades and care of shoulders. The winter of 1943-44 was very easy on frost heaves because of the small amount of moisture in the ground. The two failures which have occurred since 1940 where subsurface drainage has been installed were due to the pipe not being laid sufficiently low.

The sum of $200,000 was appropriated for the first year of the program, 1940, and then $225,000 was expended in 1941, with somewhat less each year since then. Because of the labor and equipment shortage, in 1943 only about one-third as much work was done as in previous years.

There has been a slight change in the specifications for the gravel over the perforated pipe up to the gravel base. A finer gravel, from ¼ to ⅜-inch washed gravel or crushed stone, is used now where formerly ½ to ¾-inch stone and originally as large as 2-inch stone was used.

Current Surface Drainage

Anticipating the failure of a considerable number of rusted-out plain-galvanized corrugated-metal culverts about 25 years old, plans have been made for their replacement. Old stone box culverts are being replaced with reinforced-concrete pipe unless the foundation is too soft, in which case metal pipe is being used where available. The long lengths of the corrugated-metal pipe are depended upon to bridge soft spots. All culvert sites are being checked regularly and enlarged wherever there is a history of water having run over the road. Nothing smaller than 15-inch pipe is being used to replace the many 10 and 12-inch culverts. The following table shows the comparative quantity of pipe installed in maintenance operations during the calendar years 1941, 1942, and 1943.

	Sizes	Feet of Pipe Installed 1941	1942	1943
R. C. pipe	12 to 72"	3,072	3,712	2,374
A. C. C. M. pipe	15 to 60"	501	478	534
Total		3,573	4,190	2,908

New surface-drainage installations in 1943 were made only at locations where a lack of drainage structures required expenditures to reduce traffic hazards and excessive costs of maintenance. As in 1942, the importance of the highway to be improved and the traffic volume were criterions in determining the locations for performance of the work. Twenty-three new drainage rights-of-way into private property were acquired to provide economical outlets for part of this drainage work. The following table shows type, quantity and size of pipe installed on new drainage projects in 1941, 1942 and 1943:

	Sizes	Feet of Pipe Installed 1941	1942	1943
R. C. pipe	12 to 36"	23,005	6,784	13,901
A. C. C. M. pipe	12 to 36"	1,980	504	712
Total		24,985	7,288	14,613

Gutter Sections

Some difficulty has been experienced in Connecticut with the removal of surface water from highway pavements. High shoulders and lack of gutter sections on the older highways have confined surface waters to the traveled portions of the pavements. This condition is being remedied by scarifying the shoulders, which are of an asphaltic-oil and sand mix, and regrading them to provide an adequate channel for surface-water flow outside the pavement area. In cases where poor material is found,

(*Concluded on page* 59)

C. & E. M. Photos

Trench excavation in blue clay was a problem at Stewart Field, N. Y. A Northwest 2-yard shovel dug some of the large trenches by straddling the ditch, as shown above. At the right, the dipper of the Northwest.

Drainage Installation At an Eastern Airfield

(*Continued from page* 1)

dle the hauling.

Drainage

The adequate drainage of the field required a total of 115,000 linear feet of reinforced and plain-concrete pipe and vitrified-clay tile. The reinforced-concrete pipe was used in sizes from 36 to 60-inch, the plain-concrete pipe from 18 to 30-inch, and the tile below 18-inch in the gutter areas. Catch basins for the collection of the water from the 25-foot gutter sections in both concrete and asphalt sections were spaced 75 feet apart.

In pouring concrete pavement, the gutter sections were poured first 25 feet wide, with a dip of 2.76 inches to the catch basins which are 16 feet long and located 37½ feet in from the edge of the mat pavement along all four sides. The outer edges of the gutters are 25 feet from the edge of the mat and this rim drains to the outside while the remainder of the mat drains to the gutter sections.

Much of the field drainage had to be delayed until after the greater part of the paving had been completed, as it was essential to put as much as possible of the field into operation at the earliest date. The last taxiway was the toughest part of the whole job as it crossed an area where there was a large drainage trench to be excavated by power shovel. In spite of the large area involved, it was not possible for the contractor to so schedule the work as to keep ahead of the paving at all times. The numerous shifts in the locale of the work, caused by the character of the training underway from time to time, greatly delayed the contractor's operations.

The blue clay in which much of the drainage system was laid was so tough that it had to be drilled and shot unless a large shovel was used. Small machines could not tackle the trenches, which were 6 feet deep and 4 feet 6 inches wide for the larger pipe. Mt. Vernon Contracting Co. of Mt. Vernon, N. Y., which had the contract for the drainage work, used a 2-yard Northwest shovel for trench excavation, straddling the trench and digging as it progressed forward. This would not have been possible except for the tough character of the clay which did not require any bracing in the trench, even at the maximum excavation.

Concrete Paving

The concrete paving completed to date at Stewart Field is the equivalent of 49 miles of 25-foot highway and was laid 25 feet wide with an 8-6-6-8-inch section. The designed mix, using Vinsol-resin cement, gave a strength of 6,000 pounds in 90 days with a water ratio of 4.75 gallons per sack, a sand ratio of 1.92, 1-inch stone 1.99, and 2-inch stone 1.99. The actual dry weights of the batches for the three 34-E pavers used on the job were:

2-inch stone	1,123.08 lbs.
1-inch stone	1,123.08 "
Sand	1,083.06 "
Water	237.41 "
Cement, 6-bag batch	564.00 "

A cubic yard of concrete weighed 4,130.63 pounds. The sand was barged to Newburgh from Long Island, and Hudson River trap rock was delivered

(*Concluded on next page*)

Facilities Expanded At Stewart Field, N. Y.

(*Continued from preceding page*)

in like manner and trucked to the job. Three Blaw-Knox batching plants were installed, one each for the two Rex and one MultiFoote 34-E pavers used on the runways.

Black-Top Paving

Hot-mix asphaltic material, hauled a distance of 6 miles from the contractor's plant, was used for paving the gutters on both sides of the peripheral taxiways. The Peckham Road Corp., of White Plains, N. Y., contractor for the asphalt paving, laid a total of 22,000 tons in these gutters, hauling 8-ton loads from the plant in a fleet of six trucks.

The hot-mix was spread 4 inches thick and 12 feet wide and was pulled out to 13 feet wide by four rakers working close to the Adnun Black-Top Paver. One man kept the rear rolls of the paver sprayed with fuel oil to prevent sticking of the hot-mix, and three men were used to shovel material from the hopper or truck into wheelbarrows and take it back to maintain the full thickness along the edge where the hot-mix was widened by raking. This outfit spread as high as 120 tons per hour, with the daily average running from 500 to 600 tons for a 9-hour day. The black ribbon was compacted by careful operation of a 7-ton Buffalo-Springfield tandem roller.

Personnel

The plans were made by and the construction at Stewart Field was done under the direction of the District Engineer, New York District, U. S. Engineer Department, with Major Robert L. Donnelly as Area Engineer, Lieut. John F. Kelly, Assistant Area Engineer, and J. W. Davis, Resident Engineer. The paving and drainage contract completed by the Mt. Vernon Contracting Co., of Mt. Vernon, N. Y., amounted to $3,500,000, with the work in charge of Felix Petrillo, Vice President, John McFall, Superintendent, and T. P. McParlin, Field Engineer. The black-top paving of taxiway gutters was completed by Peckham Road Corp. of White Plains, N. Y., as subcontractor.

State Action Awaits Federal Highway Bill

Speaking before the American Planning and Civic Association in St. Louis in June, H. S. Fairbank, Deputy Commissioner, Public Roads Administration, outlined the features of the new Federal-Aid Act which the House Roads Committee unanimously reported to the House of Representatives. He then pointed out the need for action by the Congress, as state legislatures will be meeting next autumn and winter and their action will be predicated on what Congress does with this bill.

"Action of the Federal Congress is a necessary preliminary to the sessions of the State legislatures next winter, for considerable state legislation will be needed before the post-war construction of really modern highways can begin. For instance, about thirty states need legislation to enable them to adopt the limited-access type of design recommended for the interregional or interstate highways.

"Better right-of-way acquisition laws are a further need in many states. The process of land acquisition usually is too slow and cumbersome. Furthermore, most state laws prohibit the taking of right-of-way width additional to that required for the physical improvements immediately planned; yet the proposed standards for the interregional highways call for immediate acquisition of sufficient right-of-way to meet the anticipated need for future widening, to protect the express character of the roads, and to permit the screening out of unsightliness.

"Another problem which the State legislatures need to solve is that of more effective cooperation between state highway departments and city administrations. Particularly there is need for some better means of dealing with the complicated situation in metropolitan areas which consist of several cities, or of a major city and numerous surrounding satellite communities. Perhaps the creation of an overall authority would be desirable in these complex urban areas to coordinate the interregional and other express routes with the metropolitan street and highway plan. If this is the solution, it will have to be legislatively provided.

"If in the planning of the new highway program there is a proper recognition of the new elements that should distinguish it as a refining, adjusting, standardizing and ultimately adequate program from the necessarily provisional character of the earlier pioneer program, that recognition will be due in no small measure to the wise initiative of the President in appointing the National Interregional Highway Committee and to the Interregional Highway report recently produced by that Committee."

PAVEMENTS UNDERMINED. At left, a concrete pavement on Route 63 in Callaway County, Mo., undermined by the flood of April 21 and 22, 1944. At right, another example of the extensive flood damage, showing washed-out fill on Route 17 in Montgomery County which resulted in the break-up of a considerable stretch of asphalt paving.

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DEEP HOLE. The repair of 1,600 feet of roadway on Route M in St. Charles County, Mo., awaits the drying out of this hole caused by the spring flood waters.

HIGH WATER. Flood waters at the crest on Route M in St. Charles County, Mo.

BRIDGE LOST. The most seriously dged bridg of Grand River on te M, Ger the 160-foot main span was washed out, wi e result mated to be so great that it is pl d to buil

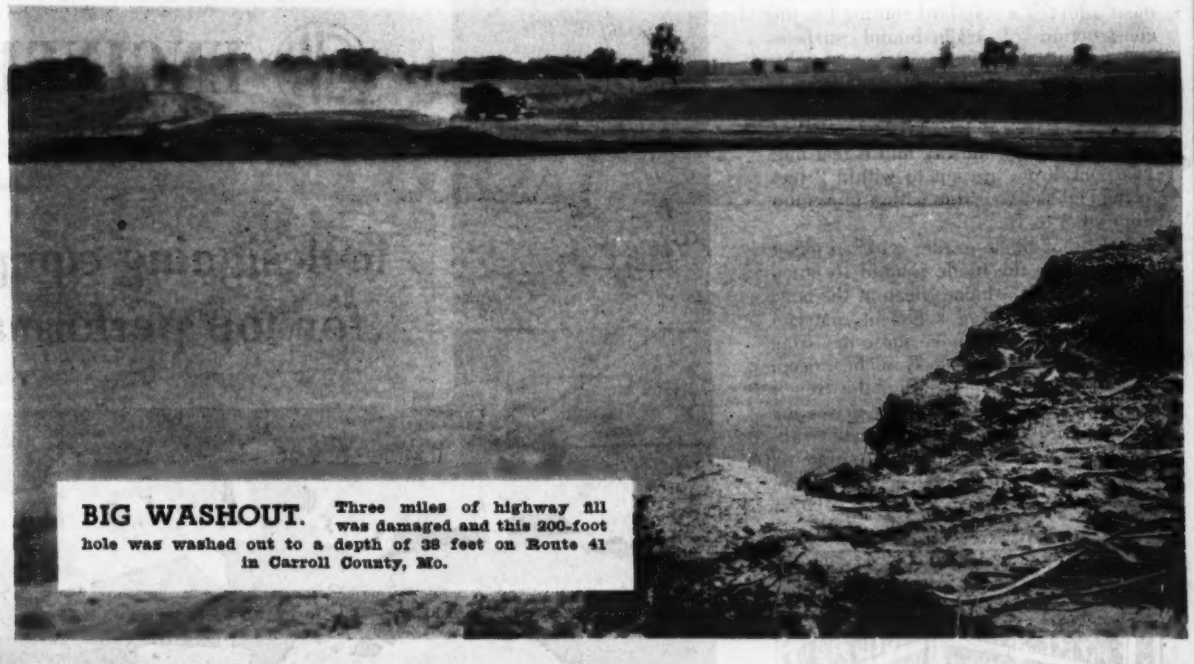
SAND BAGS SAVE BRIDGE. At left, maintenance forces constructed a pontoon bridge of old oil barrels to permit placing sand bags around the piling under the footing of a pier of the Missouri River Bridge at Courtney Bend, 5 miles south of Liberty. At right, the home-made device used for filling the bags with sand.

Wartime Problems Road Maintenance Forces

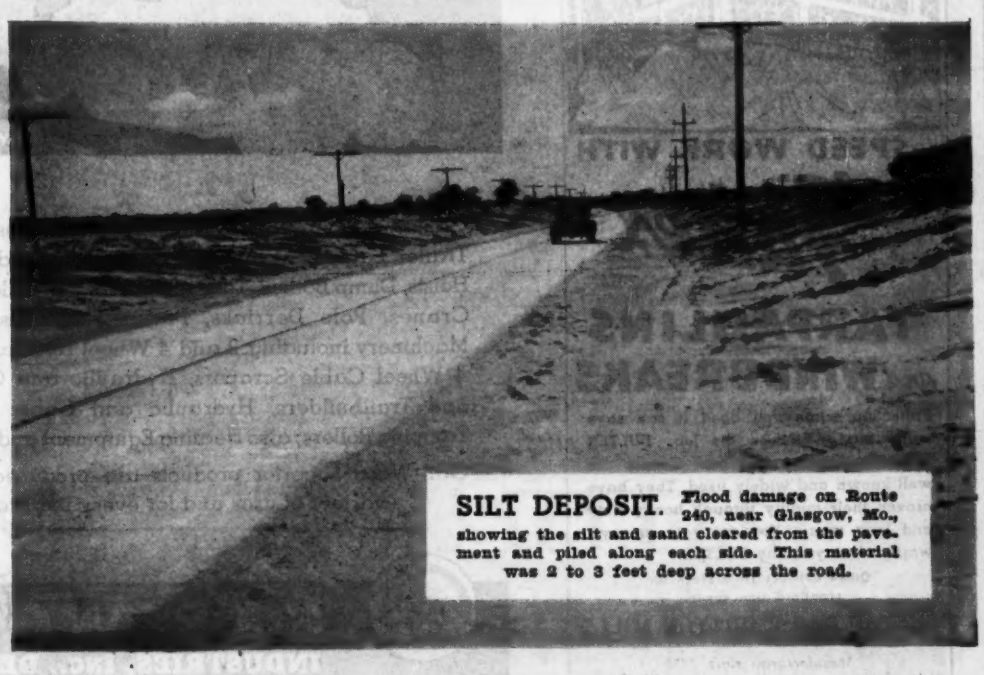
Spring Floods Wash Out Road Edges; Road Crews, Benefit by Extra Help, Make Emergency Repairs

(See article this issue)

Seriously damaged bridge was this structure over the West Fork River on Route H, Gentry County. A steel-pile pier supporting the bridge washed out, with the result shown below. Repair costs were estimated at $2,000, but it is planned to build a new bridge at this location.



BIG WASHOUT. Three miles of highway fill was damaged and this 200-foot hole was washed out to a depth of 38 feet on Route 41 in Carroll County, Mo.



SILT DEPOSIT. Flood damage on Route 240, near Glasgow, Mo., showing the silt and sand cleared from the pavement and piled along each side. This material was 2 to 3 feet deep across the road.

Building Road Bases In Winnebago County

Graded Bases for Asphalt Surfaces in This Illinois County Use Local Material And Are Well Drained

By A. R. CARTER, Winnebago County Superintendent of Highways, Rockford, Illinois

WINNEBAGO County in northern Illinois is fortunate in having suitable deposits of stone and gravel easily accessible through the county. Soil conditions vary from a sandy loam in the eastern part to a yellow clay in the northwest section, and a heavy black loam underlain with yellow and blue clay in the southwest part of the county. All of these have to be considered in grading and base construction for bituminous roads.

The abundance of natural resources, and in most instances favorable conditions for adequate subgrade drainage, together with the observation that the feather-edge base is not structurally sound for bituminous construction, are all factors which led to the decision to use the trench method of base construction on all county roads.

Base Construction

In 1933, the County Highway Department adopted a standard routine for the construction of traffic-bound surface-course pavement. On a minimum right-of-way of 66 feet, a 34-foot roadway is graded with a crown of 6 inches. Standard ditches are cut 1 foot 3 inches below the edge of the roadway and 5 feet out. The backslopes are cut to within 2 feet of the right-of-way line with a minimum slope of 2 to 1.

A 12-foot blade grader with an offset extension on the blade is used to cut a narrow trench 3 inches deep at the edge of the road, casting sufficient material on the shoulder to make the outer edge of the finished trench 8 inches deep. Hand labor is used to align the trench to its proper width, to cut trenches for French drains, and to prepare the subgrade for its application of stone or gravel-surface-course materials.

The base-course aggregate is placed upon the subgrade in three layers, each layer being thoroughly compacted by a 10-ton roller. The first course is composed of crushed stone ranging from ½ inch to 4 inches, with 10 to 25 per cent fine material passing a No. 4 sieve. The second course ranges in size from ½-inch to 1½-inch stone, with 10 to 35 per cent fine material passing a No. 4 sieve. The third course ranges from ½-inch to 1-inch material, with approximately 35 per cent fine material passing the No. 4 sieve.

The finished cross section has a 32-foot roadway with a 9-inch crown from the center to the edge of the shoulder, 3 inches in the stone surface course and 6 inches shoulder slope. It has been found from experience during the past nine years that by using at least 1 inch per foot for the shoulder slope better surface drainage is obtained and, after the root system of the turf on the shoulders has fully developed, no difficulty is experienced with the shoulders being elevated above the surface of the roadway.

French drains are built at all low points in the grade and at 150-foot intervals on each side of the low points in the grade. The trench for the drains is 8 to 12 inches wide and is excavated approximately 3 inches below the subgrade from the surface of the completed shoulder. The trench is filled with stone or gravel varying in size from ¾-inch to 1½-inch.

Surface Treatment

Bituminous surface treatment of stone bases in Winnebago County dates back fully 28 years. This type of surface treatment was done entirely by Rockford Township during that time. The use of bituminous materials for the surface treatment of roads on the Illinois state-aid system was not started until 1934.

The first bituminous construction on state-aid roads in Winnebago County consisted of two short sections of road-mix, about 3 miles in length, and 0.6 mile of surface treatment. This mileage has been added to gradually until at the present time there are 7 miles of blade-mix, 8 miles of machine-mix, 86 miles of modified surface-treatment, and 15 miles of old bituminous surfaces inherited from the townships, or a total of 116 miles.

The modified surface treatment used by Winnebago County consists in applying to the prime coat 10 to 12 pounds of gravel for cover. This material is added directly on the application of 0.5 gallon of prime material per square yard which is made necessary by the porous nature of the stone surface. There are two advantages gained in the use of the cover-coat gravel. First, it adds that much metal to the surface coat, and second, if the public insists on using the road before it has become thoroughly cured, it eliminates the possibility of picking up

(*Concluded on page 64*)

The new Industrial Handi-Crane.

Full-Revolving Crane For Tractor Mounting

Volume production of its new Model D full-revolving Handi-Crane has just been announced by the Industrial Equipment Co., 59th & Doyle Sts., Emeryville 8, Calif. Mounted on a Case Model DI tractor, the new unit has a lifting capacity, based on 75 per cent of the overturning load, ranging from 1,500 to 6,000 pounds, depending upon the boom angle and working radius. The standard boom length is 16 feet, but longer booms and special telescoping and gooseneck designs are available on order.

Designed primarily for fast low-cost load handling, the new unit is featured by high mobility and rapid accurate control, the manufacturer states. With a turning radius of 15 feet and traveling speeds up to 15 mph, the highly maneuverable Model D can lift, transport and spot loads quickly on the job or in storage yards. The controls are conveniently located and easy to operate. In addition to the regular tractor controls, which are not altered in mounting the crane, a hoist lever and turntable lever control all operations.

All load stresses are carried by the heavy-duty welded-steel frame bearing directly upon the tractor axle, relieving the tractor crankcase and transmission housing casting of all strains imposed by hoisting and transporting loads. The frame design permits easy access to the tractor engine, and the regular tractor rear power take-off and drawbar are left clear, so the unit may be used for regular tractor work.

Full information on this new Model D Industrial Handi-Crane is contained in a 4-page bulletin, No. H-101, copies of which may be secured direct from the manufacturer by referring to this item, or from this magazine.

Production Awards

Before the combination of Army and Navy Awards for excellence in war production, the Union Wire Rope Corp., Kansas City, Mo., received the Navy "E" for its outstanding production record. This company has just received its fourth renewal of this award, and because of its excellent record, may retain the flag for one year before being considered for the next renewal.

A third additional gold star has been awarded by the U. S. Maritime Commission to the Homestead Valve Mfg. Co., Coraopolis, Pa. Only twenty-two other manufacturers throughout the country have been so honored, and of the twenty-three companies who have been awarded their third gold star, Homestead Valve Mfg. Co. is one of four which increased their production 20 per cent or more during the past six months, as compared to the previous six-months period.

A third renewal of its Army-Navy "E" Award has been received by the Aurora, Ill., plant of the Independent Pneumatic Tool Co., producer of Thor pneumatic and electric tools used in the production and assembly of fighting machines and weapons.

The employees of Skilsaw, Inc., Chicago, manufacturer of portable electric tools, have received for the third time the Army-Navy Production Award for high achievement in the production of war materials. This third citation adds a second white star to the company's "E" flag.

The Blackhawk Mfg. Co., Milwaukee, Wis., has been notified of the renewal of its Army-Navy "E" Award received last November for excellence in the production of hydraulic equipment and wrenches.

A white star has also been added to the Army-Navy "E" pennant flying over the plant of the Frank G. Hough Co., Libertyville, Ill., for its wartime production of tractor shovels, sweepers, and special ordnance equipment.

Army-Navy "E" flags for excellent fabric production have been presented recently to two Alabama plants of Goodyear Clearwater Mills, a Goodyear Tire & Rubber Co. subsidiary.

Pioneer Salesman Dies

C. K. Ordway, District Manager for Pioneer Engineering Works of Minneapolis, Minn., died recently following a heart attack. He was 51 years of age. Mr. Ordway was well known from coast to coast, having been selling construction machinery for about a quarter of a century. He started with the Northfield Iron Works, and in 1922 joined the Russell Grader Mfg. Co. In 1928, Mr. Ordway was one of the first salesmen to go on the road for the Pioneer Engineering Works and during the course of his association with that company, his work took him into practically every state.

Construction of the Pacific Naval Air Base at Mugaeme, Calif., provided one of the largest dump-truck jobs in recent years. As shown, a "mountain" of decomposed granite is being moved to provide fill at the base. The truck being loaded by a Northwest shovel is owned by Roy Wiley, Compton, Calif., who has four 2-ton Dodge dump trucks on this job which have run a combined total of 830,000 miles in wartime hauling.

Line of Metal Shears For Jobs and Shops

Various models of metal shears for use by contractors, for cutting reinforcing bars and other metal on the job, and by state and county highway departments as well as contractors in their equipment repair shops and garages, are made by the Edwards Mfg. Co., Albert Lea, Minn.

Of particular interest to contractors for use on construction jobs are the Models No. 20 and No. 15 alloy steel shear. The former is built entirely of steel, carefully machined, and has a cutting range to meet all general contractor needs. The main frame is of one piece, and there are no springs or latches. The closing action of the jaw is like the lift jack. After the cut is made, the jaw drops back into place. Independent of the lever, the operator can then quickly close the jaw against the work, ready for the next cut. The stripper is quickly adjusted to different sizes of material, and the knives are 3½ inches long. It is stated that this shear, without changing knives, will cut 1⅜-inch round, 1¼-inch square, twisted or deformed reinforcing bars, or 3 x ¾-inch flat pieces. The machine is 32 inches long, 15 inches high, and weighs 245 pounds.

The No. 15 shear is especially designed for cutting bars and reinforcing steel on the job. It is built of but two working parts and alloy steel construction makes possible the combination of light weight, strength and rigidity. The manufacturer states that this unit is made for hard use and rough handling, and can easily be moved from one location to another. It will cut 1-inch round, ⅞-inch square, 3 x ½-inch flat and smaller sizes, is 22 inches long, 12 inches high, and weighs 127 pounds.

The Models No. 10 and No. 5 shears, for use either on the job or in shops and garages, are general-purpose units, similar in construction and operation, the difference being in type of pinion, weight and size. The jaw of the No. 10 is completely closed by one revolution of a small-diameter pinion on which are cast three lever sockets standing at different positions. When cutting either round or narrow flat bars, only a partial revolution of the pinion is necessary. Furnished with a 7-foot high-carbon-steel handle, this shear is 36 inches long, 17 inches high, and weighs 496 pounds.

The No. 5 is an open-end shear which will do work that cannot be done with a closed-end shear, and is designed for cutting small reinforcing bars, plow points, and similar jobs. It is 26 inches long, 13 inches high, has a 6-foot handle, 7-inch knives, and weighs 222 pounds.

A bulletin illustrating and describing all four models of these Edwards metal shears may be secured by those interested direct from the manufacturer. Just mention this item.

Appointments Announced By Caterpillar Tractor

William Blackie, formerly Controller, has been named a Vice President of the Caterpillar Tractor Co., Peoria, Ill., and William J. McBrian, Treasurer, now becomes Vice President and Treasurer, according to a recent announcement. Mr. McBrian joined the Caterpillar organization as Credit Manager in 1928 and has been Treasurer since 1938. He was formerly connected with the Standard Oil Co. of Indiana. Mr. Blackie, a native of Glasgow, Scotland, has been Controller of Caterpillar since 1939. William H. Franklin, formerly Assistant Controller, now succeeds to the position of Controller.

Announcement has also been made of the appointment of Edward W. Jackson as General Parts Manager of Caterpillar. After serving as Field Engineer since 1929, Mr. Jackson later became a Service Engineer and in 1937 was promoted to General Service Manager. In April, 1942, he was made Assistant to the President and continued in that position until his recent promotion.

Cutting and Placing Of Sod Require Care

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watched in the selection and purchase of sites for sod cutting. But, important as these factors are, the thickness of the sod at the time it is cut determines the mass of earth that has to be handled. Whenever hand labor is involved, weight is a very important factor. For the average man, 50 to 70 pounds is the right weight for a roll of sod for easy and safe handling. It follows, within limits, that the thinner the sod, the greater the square yards per man-hour. However, there are certain factors of plant growth which determine at what thickness the sod should be cut. Cool nights and short days are optimum conditions for root development for most grasses. Hence, in April and May, and again in September and October, the sod may be cut thin. In June, July and August, conditions for growth are more adverse and sod had best be cut 1½ inches or more in thickness. How thin the sod may be cut also depends upon the nature of root development and the type of sod cutter used, but 1 inch is about the lowest limit of safe handling and placing.

The size, as well as the thickness, of a piece of sod is a determining factor in the weight of the roll. This will depend upon the type of cutter and the operator in charge. Specifications are usually liberal in this matter. With most operators, strips of 15 or 18 inches in width and 4 to 5 feet in length are popular. This makes an easy roll to handle without sagging and a convenient length to place. The average sod, cut 1½ inches thick, weighs from 10 to 12 pounds per square foot. Thus 5 to 7 square feet should make the average roll 50 to 70 pounds. Some operators prefer sod cut 24 inches wide and then cut the strips 3 to 5 feet long. This larger size has often proved impractical unless the sod is of of the finest quality and the cutter performs perfectly. It should be remembered that if the rolls of sod are heavy or awkward to handle, they anger the workmen, are hard to load by hand, and thus slow up the work.

The dimensions chosen by various operators may differ widely but when a certain dimension has been selected, uniformity of size is very important. Experience has shown that standardization and uniformity of size can speed up tremendously the placing of the sod as well as the quality of the finish.

Placing the Sod

Good workmanship in placing the sod demands that the joints between the strips be close fitting. This is especially true if the sod is cut thin and a light (½-ton) roller is used as soon after watering as the surface is workable. When the sod is cut 1½ inches or more and a 2½-ton roller is used, close fitting joints are not as important. On one airport, the engineers and inspectors allowed a 2-inch opening between strips and a 4-ton roller was used immediately after the sod was placed. Good workmanship was sacrificed in order to finish the 40,000-square-yard job before winter set in, but dust erosion was still in evidence after the job was finished, due to the wide joints which the 4-ton roller did not close.

Rolling depends upon several factors. If watering is necessary, rolling should follow as soon as the surface is sufficiently dry. If the joints are wide, a heavy power roller, 2½ to 5 tons, must be used, while if the joints are close, a ½ to 1½-ton roller may be used. If the sod is thin, 1-inch or less, a heavy roller would injure the roots of the sod.

Topsoiling and Seeding of Sod

If wide joints are left after the final rolling, it becomes necessary to seed the bare areas. Specifications sometimes call for the topsoiling and seeding of sodded areas. One method is to mix the topsoil with seed and spread it after the rolling

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One-Third of Nation Relies on Rural Roads

(*Continued from page 22*)

the mud with the limited funds available. Doubtless the story in other states in the country is much the same as in Iowa.

From the limited information available, it is believed that approximately 5 per cent of the mileage of the secondary and feeder roads in all the states is paved, 38 per cent is surfaced with other materials (mostly topsoil, shale, untreated gravel, or crushed stone), and the remaining 57 per cent of the mileage has no surfacing of any kind. The 5 per cent of the mileage which is paved is located mostly in communities of less than 10,000 population.

Funds Needed for Improvement

The best information available showing the amount of funds needed at the present time for secondary and feeder-road improvement is contained in the response of the state highway departments to an inquiry sent out last October by Brady Gentry of Texas, then President of the American Association of State Highway Officials. He requested each state to send him its estimate of the amounts needed for construction on the Federal-Aid road systems, on the secondary and feeder-road systems, and on the urban highway systems. The summary of the replies show funds needed as follows:

Federal-Aid road system	$5,315,000,000
Urban highway system	2,534,000,000
Secondary and feeder-road system	3,289,000,000
Total	$11,138,000,000

These estimates are approximate only, and doubtless were prepared in most of the states without the benefit of detailed estimates of quantities of the various items of work to be performed. That information can be developed only after detailed surveys and plans have been prepared, and even if the exact quantities of each kind of work were now definitely known, no one knows exactly what unit prices should be applied to each item of work to be constructed after the war is over. Comparing one state with another, one might well doubt whether all states based their estimates on the same general assumptions and the same standards of improvements. There is room for belief that in some states the amount estimated for secondary and feeder roads is much too low. But these estimates represent the best and most complete information now available on the subject.

Basis for Allotment of Funds

It is of interest to note that the amount estimated as needed for secondary and feeder roads, $3,289,000,000, is 29.5 per cent of the total amount estimated as needed for construction on all classes of roads. We thus develop the following facts:

1. That 33.4 per cent of the population of the United States lives on rural secondary roads and has a direct interest in their improvement.
2. That 34.5 per cent of the total annual vehicle-miles of traffic on all public highways is on the secondary and feeder roads.
3. That 29.5 per cent of all needed highway construction, as reported by the various states, is on secondary and feeder roads.

The average of these three percentages is 32.5 per cent. We might, therefore, with some justification conclude that roughly one-third of any funds that may be authorized by Congress for post-war construction should be made available for use on secondary and feeder roads.

But the problem of the amount or percentage of highway funds which should be allotted to secondary and feeder roads is not as easy as that. Other factors have a bearing on this matter, two of which will be mentioned.

The first is that it necessarily costs more per vehicle-mile of traffic to construct and maintain secondary and feeder roads than Federal-Aid roads or urban highways. This point is based on the accepted principle that quantity production results in lower unit production costs. In the case of highways, the article produced is highway transport. The unit of production is the vehicle-mile or the ton-mile of traffic. The highway system is merely the fixed plant for producing this article.

Obviously, the general average daily traffic per mile on secondary and feeder roads is much less than on Federal-Aid or urban highways. In the estimates of annual traffic for the various classes of roads previously mentioned, the average daily traffic on secondary and feeder roads was estimated at 100 vehicles per mile of road per day, Federal-Aid road traffic at an average of 1,165 vehicles per mile of road per day outside of municipalities and inside communities of less than 10,000 population, and an average of 2,100 vehicles per mile of road per day on roads in municipalities over 10,000 population.

On any given road, it costs a certain sum per mile to construct grades, bridges, culverts, and surfacing suitable for an average daily traffic of 100 vehicles. It would cost substantially no more to construct that road if it carried an average of 200 vehicles per day. The right-of-way, the grades, bridges, culverts, and generally speaking the surfacing would be substantially the same, and the total construction cost per mile would be the same. But the construction cost per vehicle-mile of traffic on the 200-vehicle-a-day road would be only half as much as on the 100-vehicle-a-day road.

Much the same is true with respect to maintenance. It costs just as much to clear the snow from a 100-vehicle-a-day road as from one carrying 200 vehicles

(*Concluded on next page*)

Rural Road System Needs Improvements

(*Continued from preceding page*)

a day. And the road must be opened if the school bus, the milk truck, the mail carrier, and other necessary daily transport services over the secondary roads are to get through.

In Iowa in 1941, the cost of constructing and maintaining rural secondary roads was 1.81 cents per vehicle-mile of secondary road traffic, as compared with 0.77 cent per vehicle-mile of traffic on Federal-Aid roads. Thus, the rural secondary-road traffic cost the taxpayers 2.35 times as much per vehicle-mile as the Federal-Aid road traffic. This is not evidence of incompetence on the part of secondary road officials; it is evidence of an economic law which we cannot evade.

The second factor which must be considered is that in most states very considerable amounts of local property-tax funds are expended on secondary and feeder roads, which is not true of Federal-Aid roads. The latter, with possibly minor exceptions, are financed exclusively from road-user taxes and Federal-Aid funds. In Iowa, Federal-Aid roads receive no support from property taxes, while rural secondary roads have received about $11,500,000 per year from that source.

Such sources of local highway income and the purpose to which such income is applied are matters of importance in determining an approximately equitable division of Federal highway funds among the different classes of roads. Such detailed information is not available, and even if it were, doubtless conditions would be found to vary so widely in different states that the data could be used only with much discretion and sound judgment.

Standards for Rural Work

A comparatively small sum of money will improve large mileages of secondary and feeder roads. Traffic on a large percentage of the mileage is light. Standards of construction are correspondingly light. The design of each such road should be "tailor made" to fit the traffic requirements on that particular road, and the road should be built for utility. Generally a light inexpensive untreated-gravel or crushed-stone surface is sufficient on rural sections. Relatively narrow grades and bridges may be used. In Iowa in 1941 the complete cost of construction on such rural roads, built to Federal-Aid secondary-road standards, was $5,540 per mile, divided as follows:

Grading and small circular culverts	$2,499
Graveling	1,030
Culverts (exclusive of small circular culverts)	487
Bridges (20-foot span or less)	1,524
Total	$5,540

Not all of the vast mileage of rural secondary and feeder roads need to be improved. Only about one-half of this mileage is used as rural mail routes. Studies in Iowa lead to the conclusion that by improving about 83 per cent of the rural secondary-road mileage, a surfaced road could be provided to each farm house. A goodly portion of the remaining 17 per cent of the mileage is so little used as to be nothing more than land-use trails which could well be abandoned as public highways and the land turned back to crop production.

Conclusion

Thus far, we have not attempted to develop any exact percentage of total road funds which should be earmarked for secondary and feeder roads. There are so many variable and unknown factors in this problem that we do not believe that any exact determination thereof is possible. There is no mathematical formula which leads precisely to the answer. The problem is open to the exercise of much sound discretion. However, it would seem that the earmarking for secondary and feeder roads of one-third of the amount authorized for post-war highway construction would not be too much.

We thus briefly call attention to the needs and claims of the secondary and feeder roads. These roads are the "poor relation" of the highway family group. They ask little; they return much in highway service. They are the "bread and butter" roads of the people close to the soil. They carry our food from farm to market. They carry the country child to school in the village or town and back home again in the evening. They carry the daily mail to one-third of all our population. No one can say where these roads begin, whither they go, or where they end. They reach into the remote corners of our land and promote the social, religious and economic welfare of our people.

From a statement at Congressional hearings on the new Federal-Aid Bill before the House Roads Committee.

Truck Industry Will Fill Civilian Quota

Contrary to earlier reports, the truck industry expects to fill its 1944 quota of 101,000 trucks for essential civilian use, according to C. T. Ruhf, President of Mack Trucks, Inc., New York City. The civilian truck total was raised to 101,000 from 88,000 following recent cut-backs in military truck production. The cut-back, spread over the entire industry, was greater than the subsequent increase in the civilian truck quota.

During the first four months of this year, the industry produced 18,039 trucks for civilian use and more than 200,000 trucks and truck tractors for the armed services. The slim civilian production for the four-month period seemed to foreshadow a grave disparity between the assigned quota of 88,000 at that time and the actual number that would be produced, the Mack executive said. The present military cut-back and the others which can be anticipated as the European war progresses are expected to leave the industry with sufficient production capacity to meet a quota even greater than the new 101,000 ODT allotment for civilian use.

New Anti-Friction Idler For Belt Conveyor Units

A new 16-page illustrated catalog issued by the Link-Belt Co., 307 No. Michigan Ave., Chicago, Ill., describes various types of the "100" Link-Belt anti-friction belt-conveyor idler, including flat-roll carrying and return idlers, troughed self-aligning and carrying-run idlers, and self-aligning return idlers. Features of this equipment include a positive grease seal on the anti-friction bearings; troughing rolls accurately aligned in a sturdy streamlined steel frame assembled in jigs to assure correct bracket spacing and roll interchangeability; roll shafts locked in the frame but capable of quick removal; interlocking nuts and yokes to keep the roll supporting brackets from spreading; pipe extensions for safe center-roll lubrication from one end of the troughing idler unit; and rolls of equal length and interchangeable. In addition to describing the present-day equipment, the catalog contains interesting illustrations showing the progress of Link-Belt conveyors since 1896.

Copies of Book No. 1915 may be secured direct from the Link-Belt Co. by mentioning this item.

Truck Mixers Pave Apron For Hangar

Redwood Expansion Joints Used at West Coast Naval Air Station for Concrete Paving on Sand Fill

+ PRELIMINARY to the construction of a new hangar at a West Coast Naval Air Station, a contract was awarded recently to Johnson, Drake & Piper of Oakland, Calif., for the construction of an 8-inch plain-concrete apron surrounding the site, with additional untreated rock paving for the hangar floor.

The concrete pavement was poured in lanes 12½ feet wide, having a ¾-inch redwood expansion joint placed every 100 feet, with grooved and poured dummy joints provided for contraction at 20-foot intervals. Dowels ⅞ inch in diameter and 14 inches long were placed on 12-inch centers through all expansion joints. Longitudinal construction joints were poured with tongue-and-groove construction, and ¾-inch redwood joints were placed longitudinally at 100-foot intervals, or every eighth lane, in place of the tongue-and-groove joints used between the other lanes.

Mooring eyes made of ¾-inch rods 2 feet long, laid horizontally in the pavement with a loop at mid-length exposed by a depression formed in the concrete, were placed at spacings of 10 feet in one direction and 12½ feet in the other.

Grading

Grading operations consisted of placing a sand fill over the existing ground surface. A Koehring crane with a 1-cubic-yard Page dragline bucket loaded loose sand, previously dredged from the bay bottom to a storage area located on the Station 2 miles away from the site of the hangar, into Ford and Chevrolet trucks, varying in number with their availability, and all hauling loads of 5 cubic yards.

In the loose sand of the dredged-fill area, in dry weather it was necessary to provide tracks for the loaded trucks. These runways consisted of strips of locked mesh wire fencing, 3 feet wide, laid on the surface of the sand in the direction of travel.

A Caterpillar D7 tractor with a LeTourneau bulldozer and two Caterpillar motor graders spread the sand fill, and compaction was obtained by this equipment and the hauling trucks.

Paving

Blaw-Knox steel forms were set by a crew of ten men who also pulled and transferred them between settings. Fine grade for the 8-inch uniform-thickness pavement was prepared by a Lewis subgrader.

Concrete was delivered in truck mixers from the plant of the Henry J. Kaiser Co., located on the Station, and shoveled by four men to the Hercules-powered Lakewood finishing machine having two screeds and a tamper. Six more men set the expansion joints and cut the grooves for the dummy contraction joints, while four finishers checked the surface and edged the joints. Membraneous curing compound was sprayed on the completed surface by two men.

After the concrete pavement had been completed, an area 395 feet long x 270 feet wide, on which the hangar was to be constructed under a separate contract, was surfaced with an 8-inch compacted layer of untreated rock.

Quantities and Personnel

The contract for this work was awarded by the Bureau of Yards and Docks, U. S. Navy, to Johnson, Drake & Piper of Oakland, Calif., on a low bid of $85,000. The contract was completed in the allotted time of 45 calendar days. The principal items included 36,380 square yards of concrete pavement, 8 inches thick, and 11,650 square yards of untreated rock surfacing.

George Warren was Superintendent for the contractor, while the work was under the supervision of Lieutenant Miles C. Newton, (CEC) USNR, Resident Officer-in-Charge of Construction, for the Navy Department, with W. A. Burris as Chief Inspector.

Black Resigns from WPB; Resumes Dealer Position

George W. Black, who has been serving as New York Regional Manager of the Construction Machinery Division of the War Production Board since 1942, has resigned to resume his former position with the Smith Tractor & Equipment Co., Irvington, N. J. Mr. Black was on leave of absence since 1942 for the purpose of organizing the Construction Machinery Division of WPB in the New York area which during the period of its existence has cleared millions of dollars worth of new and used construction machinery for the armed services, Lend-Lease, and for contractors engaged in war work.

Mr. Black will be succeeded by T. D. Harter, former District Manager of the WPB Syracuse District Office, who before entering government service was engaged in the construction machinery business in that city.

New Metallizing Gun Sprays Metal Faster

The newest Metco Type 3E metallizing gun sprays ⅛-inch zinc, tin, lead, solder, babbitt, cadmium, or fine-gage copper and copper alloys at far greater speeds than ever before. It is made by Metallizing Engineering Co., Inc., 38-14 30th St., Long Island City 1, N. Y. Typical applications, where this gun cuts costs and broadens the opportunity for spraying low-melting-point metals, include: corrosion-resistant coatings on iron and steel structures and equipment, water and chemical-resistant linings for storage tanks, conductive and soldering surfaces on glass, plastics, and carbon products.

Regardless of the type of wire employed, no gear changes are necessary to attain the high speeds with this new gun. Any spraying speed is automatically obtained and maintained. In common with all Metco metallizing guns, the Type 3E is equipped with a universal gas head which allows the tool to be operated on any commercial gas in conjunction with oxygen and compressed air.

Owners of Metco Type E or 2E guns may have their present equipment quickly converted to a Type 3E, or, should the demand arise at a later date, the Type 3E may then be converted back to the standard Type E or 2E.

Full particulars regarding this new high-speed metallizing gun will be found in Bulletin 46 which may be secured from the manufacturer.

New Curing Compound For Concrete Slabs

A new concrete curing compound which is reported to be highly impermeable has been announced by Dewey & Almy Chemical Co., Cambridge 40, Mass. This compound, Daraseal, is a blend of hydrocarbon waxes combined with non-waxy materials which inhibit segregation and favor continuity and impermeability of the film.

On horizontal surfaces and on vertical surfaces, a controlled yield-point-factor, that is resistance to flow, is desirable for many reasons. For example, the usual horizontal concrete surfaces, such as airport runways and highways, while appearing smooth, are of course relatively rough, with a series of minute hills and valleys inherent in the nature of the finish of the concrete. An ordinary liquid, flowing freely on being sprayed, runs into the depressions, leaving thin spots on the high points, thus lowering the overall efficiency of the curing compound. However, the manufacturer states that, since a controlled yield-point-factor is one of the features of Daraseal, its spray hits the surface and stays put without appreciable flow, allowing the operator to build up, with a single application, a film of any desired uniform thickness.

An 8-page bulletin has been prepared on Daraseal, which meets A.S.T.M., Federal and state specifications for concrete curing compounds, and may be secured direct from the producer by mentioning this magazine.

Maintenance Aided By Drainage Program

(*Continued from page* 45)

the shoulder is excavated to a depth of at least 8 inches and refilled with a clean gravel as a base for subsequent oiling. A definite program is being set up in each highway district whereby a portion of this work can be done each year.

Shoulder Maintenance

As a general rule, the shoulders of main highways in Connecticut are maintained true to the type, shape, line and grade of their original construction design. In some cases, shoulders have been changed to conform with new designs more favorable to roadway widths, to drainage, or to other pertinent conditions. Under all circumstances, however, the surface of shoulders is kept reasonably smooth for traffic use and the inside edge of shoulders is kept flush with the adjoining pavement. The method used in maintaining shoulders depends entirely upon their type. Untreated earth shoulders and untreated gravel shoulders are shaped from time to time by either a grader or a road hone. If necessary, new material is added during the shaping operation.

Holes and depressions in grassed shoulders are filled with loam which is both graded and seeded by hand. Grassed shoulders which are too high or generally out of shape for some other reason are scarified, reshaped with a grader, and reseeded. New material is added if needed.

Bituminous-treated earth shoulders and bituminous-treated gravel shoulders are given an overall surface treatment whenever necessary to prevent their becoming disintegrated or out of shape. Overall treatment is preceded, if necessary, by work on separate locations when shoulder conditions are especially poor. Excessively rough or uneven places are smoothed by a plane and hone or scarifier and grader, depending on the degree of roughness. Settled areas are always brought to grade by the addition of suitable material which, after being placed and shaped, is given an application of suitable bitumen at the rate of 0.25 to 0.5 gallon per square yard. In the overall treatment, the bitumen is applied at the rate of 0.167 to 0.25 gallon per square yard. This application is immediately covered with sand at the rate of 8 to 10 pounds per square yard, followed by honing, which is continued until the sand and bitumen are thoroughly mixed and the shoulders smoothed and properly shaped. Additional application of sand may be necessary after the honing to prevent traffic picking up the material.

When treating shoulders of higher-type pavements, such as concrete, bituminous-concrete, bituminous-penetration and stone-surfaced pavements, care is exercised not to carry the shoulder-treatment work onto the adjoining pavement. When overall treatment is not necessary, holes or depressions that develop in the shoulders are patched with an approved pre-mixed patch material.

Bituminous-concrete and bituminous-penetration shoulders which develop depressions and holes are maintained by filling the holes to grade with a bituminous concrete similar to the material used in their construction. When surfaces require retreatment or sealing because of oxidation, age or wear, they are given a standard stone surface treatment.

When concrete shoulders are not too badly cracked or broken, they are repaired with new concrete. For extensive repairs, however, the use of new concrete is not considered economical, and a suitable surface treatment with bitumen and cover or a skin coat of dense-mixed bituminous concrete is used if grades will permit.

Bureaus Cooperate

In shoulder and drainage maintenance the Bureau of Maintenance and Bureau of Roadside Development of the State Highway Department cooperate closely. When work is to be done on the shoulder of a road to improve surface or subdrainage and there is a bad condition in the backslope which is to be attended to by the Bureau of Roadside Development, the two operations are carried on simultaneously, decreasing the cost of both.

An interesting example of this occurred at the top of a grade in a shallow cut on U. S. 44. During the winter a 3-foot icebank developed from a spring outside the right-of-way line. The Bureau of Roadside Development installed subdrainage in the face of the slope to intercept this water before it reached the pavement and then carried the drainage to the subsurface drainage structure which was installed at the same time by the Bureau of Maintenance.

Murphy of Caterpillar Forms Texas Dealer Firm

Howard R. Murphy, Manager of the Merchandise Department of the Caterpillar Tractor Co., Peoria, Ill., has resigned from that position to become associated with W. K. Holt in the Caterpillar distributorship in San Antonio and Corpus Christi, Texas. Mr. Murphy joined the Caterpillar organization in 1927, and in 1930 was called to take over the managership of the Lampert Implement Co., Caterpillar dealer for central Washington. He completed that assignment in one year and returned to the Caterpillar Sales Department, where he has served in various capacities. In 1943, when the Special Products, Merchandise, and Order Departments were combined in one, Mr. Murphy was appointed to the managership.

U. S. Coast Guard Photo

Those dipper teeth are pointed at Tokyo. Another example of American construction equipment gone to war is this Buckeye Clipper shovel coming off an LTS ship at an island in the Pacific. It will shortly fill bomb craters and dig material to convert the puny landing strip left the Japs into a Class A-1 landing field. Buckeye Clippers are in the scrap on every front.

New Metal Etcher For Tool-Room Use

To supplement the larger machine-shop tool etcher, the Ideal Commutator Dresser Co., Sycamore, Ill., has announced a new tool-room model which will take care of most tool-marking jobs in state and county highway department shops and garages and on construction jobs. Anything made of metal can be marked for identification with this new tool.

The depth of the mark is controlled by the etching heat and the speed of writing. Four etching heats are available, 120, 240, 420 and 700 watts. Features of the tool include a red indicating lamp, a protected four-heat switch, a removable hinged cover, a terminal tap for the small 2-ounce etching tool, and a renewable work plate. All parts are enclosed in a compact case.

Copies of a bulletin describing and illustrating this new Ideal etcher may be secured by those interested direct from the manufacturer.

Save Lives by Saving Rope

The occupation of the Philippine Islands cut off our best source of supply of manila, from which the best rope is made. When the Japs took the Dutch East Indies, we were deprived of the better grades of sisal fiber, after manila the best for rope making, and present sources are insufficient to take care of requirements. To offset the resulting curtailment in the production of material so vitally important to our Army, Navy and Air Forces, it is essential that every possible method of conservation be employed to make present supplies go as far as possible. If every piece of rope now in use were made to last only 10 per cent longer, approximately 20,000,000 pounds of fiber would be added to our country's stockpile.

A small illustrated booklet, prepared by the Rope Conservation Campaign Committee and approved by the War Production Board, contains many practical suggestions for the proper care of manila rope, proper methods of splicing, and a chart of specifications for rope safety. These conservation measures will not only result in the best use of your own supply of rope, but more important still will make more rope available for our armed forces.

Rope users can secure copies of the booklet, "The Rope You Save Fights For You!", by writing to the Plymouth Cordage Co., North Plymouth, Mass. Please mention CONTRACTORS AND ENGINEERS MONTHLY.

LeTourneau Announces More New Distributors

Additions to its new distributor organization, which is now well over the half-way mark with a total of thirty-seven firms, have been announced by R. G. LeTourneau, Inc., of Peoria, Ill. The new dealer list includes: Hunter Tractor & Machinery Co., Milwaukee, Wis.; Dempster Bros. Inc., Knoxville, Tenn.; The Crook Co., Los Angeles, Calif.; Contractors Machinery Co., Grand Rapids, Mich.; J. E. Ingram Co., San Antonio, Texas; Phillippi-Murphy Co., Minneapolis, Minn.; Pacific Hoist & Derrick Co., Seattle, Wash.; Florida Equipment Companies of Jacksonville, Tampa, and Miami; Cyril J. Burke, Detroit, Mich.; Phillips Machinery Co., Richmond, Va.; Contractors Equipment & Supply Co., Atlanta, Ga.; Landes Engineering Co., Salt Lake City, Utah; Gibson-Stewart Co., Cleveland, Ohio; Conley-Lott-Nichols, Dallas, Texas; and Rozier-Ryan Co., St. Louis, Mo.

How Forest Service Cares For Equipment

Branch Shops Organized For Preventive Maintenance And Emergency Repairs During Forest Fires

Part III

♦ MORE efficient field inspection for preventive maintenance and a decrease in the work required of the U. S. Forest Service Equipment Repair Depot at Arcadia, Calif., have resulted from the establishment of branch shops in the National Forests and Emergency Rubber Project for which the Arcadia Depot performs equipment repairs. This depot maintains automotive and construction equipment used in the Cleveland, San Bernardino, Angeles, Los Padres, Sequoia, and Inyo National Forests of southern California, as well as that used by two units of the Emergency Rubber Project and the Aircraft Warning Service.

The large and well-equipped Equipment Depot at Arcadia (See C. & E. M., July, 1944, page 12) performs major overhauls, painting, and body and fender work, but in order to provide efficient field inspection and minor repairs with a minimum of travel, branch shops have been established at each National Forest except Inyo, and at each Emergency Rubber Project unit.

A Typical Branch Shop

A typical branch shop consists of a 32 x 80-foot building of native redwood, divided into six bays, each with a hand-operated 11-foot overhead door, all on the same side of the building. An office and parts room occupies 20 feet at one end of the building, with the remainder open for shop use. Nearby is a smaller lubrication building in which is a Curtis lift and either a Lincoln or Alemite pressure lubrication outfit.

A foreman, who handles the small amount of clerical work performed at these branches, and from two to six mechanics constitute the staff. Each mechanic in the branch shop has been trained in the main shop for a minimum of two weeks and at least one of the mechanics has had particular training in the upkeep and repair of the fire-fighting equipment which is used in this vital part of Forest Service operations. Semi-annual meetings, lasting two or three days, for all branch shop foremen are held at the main shop, at which time problems of supply and procedure are discussed and ideas exchanged.

Each branch shop is equipped with necessary work benches and vises, rolling jacks, a brake-lining machine, an air compressor, a battery charger, a valve-facing machine, power-driven emery wheels and buffers, expansion reamers and a 50-ton hydraulic press. Heavy-duty socket sets are standard equipment, as are special tools furnished by equipment manufacturers for use on their machines. Hand tools are supplied by the individual mechanics. Portable welding and cutting equipment, both electric and oxy-acetylene, is available in all branch shops.

Two pick-up trucks, with installed storage for small, frequently used parts, are stationed at each branch shop and used for field checks and minor repairs, particularly the "B" preventive-maintenance checks made on automotive equipment at 2,500-mile intervals. About half of the "B" checks are made in the field, thus eliminating the necessity for a trip to the shop. In order further to reduce unnecessary travel, all branch shops are located adjacent to the Forest warehouse and most shop-performed "B" and "C" checks (See C. & E. M., June, 1944, page

(*Concluded on page 82*)

A U. S. Forest Service field utility truck.

Record Floods Hit Missouri Highways

Major Washouts, Slides and Damage to Bridges Cause $200,000 Damage; Regular State Crews Make Repairs

By REX WHITTON, Engineer of Maintenance, Missouri State Highway Department

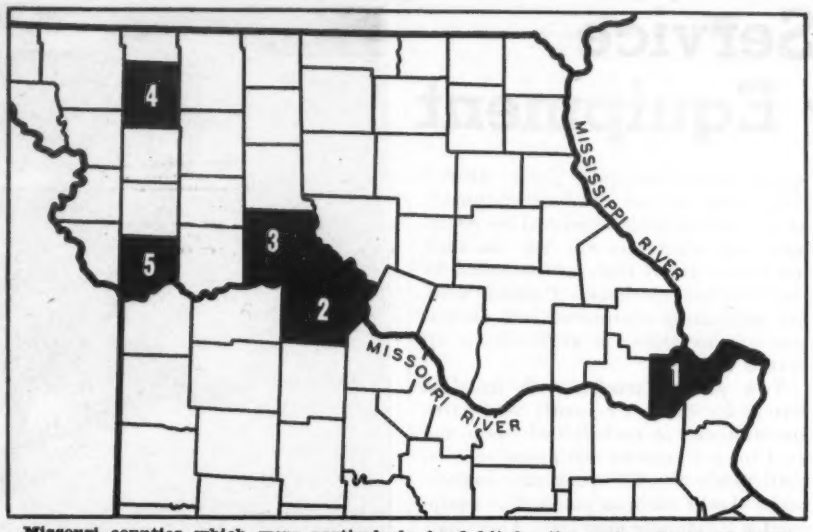
(Photos on pages 48 and 49)

✦ RAINFALL above normal in the Missouri River Valley in Missouri through the late winter and early spring months of 1944, coupled with rains of flood-making proportions on April 21 and 22, resulted in record-breaking floods in the Missouri River all the way across the state. The flood crest at Glasgow, Mo., reached an all-time high, while the crest at Jefferson City, Mo., was the highest recorded since 1903.

Actual damage to state highways and bridges is estimated at $200,000. This total was made up of several major washouts, together with many minor washes and slides. Possibly the worst roadway washouts occurred on Route H, St. Charles County, in east central Missouri, and Route 240, Saline County, in the central portion of the state. The washout on Route H, St. Charles County, occurred about 6 or 7 miles northeast of St. Charles and resulted in the total loss of 1,600 feet of roadway. While the flood waters still remained in the hole created by the washout, no plans for replacing the roadway were made by the Department.

The flood damage on Route 240, Saline County, approximately 5 miles west of Glasgow, resulted in the loss of 900 feet of concrete pavement and roadbed, leaving a hole some 16 to 20 feet deep filled with water. On both sides of the washout, sand and silt were deposited on the roadbed to a depth of 2 to 3 feet for a distance of one-half mile. The Alton Railroad is parallel and approximately adjacent to Route 240 at this point on the river side of the highway, and the railroad lost an even greater length of its roadbed. Through the efforts of the Alton Railroad, a sand dredge was secured to pump sand into the base of both the railroad and highway fill. The Missouri State Highway Department, through bids from contractors, completed arrangements for the replacing of the remainder of the highway fill with rock and earth. The contractor is using a power shovel, several trucks, and a bulldozer in this work. It is estimated that the total cost of replacing the fill and pavement will be $55,000. A temporary by-pass road was constructed to take care of traffic.

Another similar but smaller washout occurred on Route 41, Carroll County, some 2 or 3 miles north of Miami, in central Missouri. Three miles of highway fill across the Missouri River bottom was badly damaged, and at one point 200 feet of the highway fill was washed out, leaving a hole 38 feet in depth below the natural ground line across the highway right-of-way. This particular roadway is being replaced by equipment rented from a contractor. The estimated cost of the work is $29,500. On practically all highways along or across the Missouri River Valley in Missouri, damage of varying intensity occurred to roadbeds.



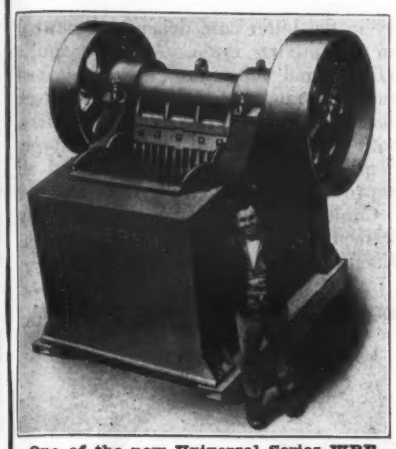
Missouri counties which were particularly hard hit by the spring floods of 1944: 1. St. Charles County; 2. Saline County; 3. Carroll County; 4. Gentry County; 5. Clay County. The severe damage to highways and bridges greatly taxed the facilities of the State Highway Department.

Still another type of damage to roadways, caused by heavy and extensive rains, was the slides which in some cases are extremely difficult and expensive to correct. Each slide presents an individual problem in its correction.

Damage to Bridges

Highway bridge damage was experienced at several locations. Possibly the worst damage occurred to the bridge over the West Fork of Grand River on Route H, Gentry County, in northwest-

(Concluded on page 87)



One of the new Universal Series WRB welded-steel-plate roller-bearing jaw crushers.

Welded Steel Plates Feature Jaw Crushers

A series of welded-steel-plate roller-bearing jaw crushers, designated as the WRB series, has been added to the line of more than twenty-four sizes of steel and semi-steel cast-base jaw crushers with roller and bronze bearings, made by the Universal Engineering Corp., Cedar Rapids, Iowa. Two sizes of the new series are now in production and other sizes will be added as conditions permit. One size has a 30 x 42-inch feed opening, and the other and smaller size, a 20 x 36-inch feed opening.

Lateral and transverse ribbing and heavy-plate side walls impart the structural strength necessary to prevent distortion of the frame or misalignment of bearings, yet add no excess weight. Four SKF roller bearings are used, two on the pitman and two on the frame, one on each side. Bearings are labyrinth-sealed against grit and grease and are Alemite-lubricated.

The new WRB series employs the same crushing action as the first overhead eccentric crushers built by Universal in 1906. Two distinct crushing blows with each revolution of the eccentric shaft are produced by the high eccentric and radial toggle action, one a primary blow at the top of the jaws and the other a secondary stroke at the bottom.

Further information on these new Universal crushers may be secured direct from the manufacturer by referring to this item.

Portable Megaphone For Construction Jobs

A new portable electric megaphone, said to project intelligible speech under favorable conditions up to one-half-mile distance, has been announced by the National Scientific Products Co., manufacturer of electric and electronic equipment. The manufacturer states that these megaphones have proved valuable to contractors and engineers on jobs where ability to give instructions to a group of workers at a considerable distance is important.

The equipment includes a megaphone cabinet, which is waterproof so that it may be completely immersed without damage; an amplifier chassis shock-proofed to the top section of the cabinet and permitting easy access to condensers, resistors and component parts for ready servicing or replacement; and a microphone and speaker containing the new molded phenolic diaphragms which are also completely waterproofed. The batteries used are said to provide 40 hours of efficient operation and still retain 70 per cent of their original voltages; power is consumed only during the actual transmission of the voice. The megaphone cabinet is 9½ inches x 4½ inches x 7⅛ inches in size, and weighs 11¼ pounds. The speaker is 13¼ inches long with a 7¾-inch-diameter bell opening. The complete unit, including megaphone and cabinet, weighs 15 pounds 5 ounces.

Further details may be secured direct from the National Scientific Products Co., 5013-25 No. Kedzie Ave., Chicago 25, Ill. Just mention this item.

Armco Purchases Assets Of Two Culvert Companies

The American Rolling Mill Co., Middletown, Ohio, has acquired the assets of the Ohio Corrugated Culvert Co., of Middletown, and the Shelt Co., of Elmira, N. Y., according to a recent announcement. Both companies will be operated by Armco Drainage & Metal Products, Inc., an Armco subsidiary. The Ohio Corrugated Culvert Co., operating in Ohio and West Virginia, was organized early in the 1900's and was a pioneer in the manufacture of metal culverts and other allied products. The Shelt Co. has been manufacturing drainage products since its organization in 1930, and has distribution in New York, Pennsylvania, and New Jersey.

Winnebago County Has Good Low-Cost Roads

(*Continued from page* 50)

the bituminous prime.

The second operation is to apply two cover coats to a width 2 feet less than the prime coat, using about 45 pounds of gravel in the two applications and 0.3 gallon of bituminous material in each course. As soon as the gravel is applied it is worked with a broom drag and then rolled by a 10-ton 3-wheel roller.

The final course, or seal coat, is delayed as long as possible. This course consists of 0.3 gallon of bituminous material per square yard, covered with about 18 pounds of seal gravel per square yard, and is treated in the same manner as the two cover coats.

The gradation of both cover-coat and seal-coat gravel varies slightly from Illinois state specifications. This gradation has been selected for use in Winnebago County after much experimenting with different gradations.

A comparison of the state specifications and the ones used by Winnebago County, showing the slight differences, are given below:

For Cover-Coat Material

Passing	County	State
¾-inch sieve	100 per cent	100 per cent
½-inch sieve	85 to 100 per cent	95 to 100 per cent
⅜-inch sieve	30 to 65 per cent	15 to 40 per cent
No. 4 sieve	3 to 10 per cent	0 to 5 per cent

For Seal-Coat Material

½-inch sieve	100 per cent	100 per cent
No. 4 sieve	26 to 45 per cent	20 to 45 per cent
No. 10 sieve	3 to 7 per cent	0 to 45 per cent

The County is fully cognizant of the fact that this type of construction is not as durable or long-lived as the higher types and requires more maintenance. It has the advantage, however, that if a base failure occurs the investment in the surface is less and similarly the surface replacement is less difficult and less expensive.

Prepared from a paper presented at the First Illinois State Asphalt Conference, Springfield, Ill., February, 1944.

New Outdoor Welders

Two new outdoor alternating-current welders, one a 500-amp and the other a 300-amp unit, have been announced by the Electric Welding Division of the General Electric Co., Schenectady, N. Y. The 500-amp welder has a current range of 100 to 625 amps, while the range of the 300-amp welder is from 60 to 375 amps. Both of these new welders are specifically designed for outdoor use where exposure to the weather is common.

The welders are equipped with an "idlematic" control which functions to reduce the output voltage automatically to less than 30 volts whenever the arc is not in operation, yet provides full power for welding directly the arc is struck. In addition, this control is provided with a switch, conveniently operated by a handle projecting through the top of the case, for shutting off the welder when not in use.

Protection against the entrance of rain, snow and sleet is provided by the dripproof construction of all openings in the top of the sturdy enclosures of the welders, and by a sealed window over the current indicator. The ventilating openings serve both to shed water and to keep air velocity low. A special finish on all internal parts provides protection against corrosion from moist air.

These welders also incorporate all of the features of the General Electric indoor a-c welders of this type, including built-in power-factor improvement, fingertip adjustment, stepless current control, and fan-forced ventilation.

Portable Asphalt Plants

A 24-page catalog illustrating and describing a line of portable asphalt plants is available for distribution by the F. D. Cummer & Son Co., E. 17th & Euclid Sts., Cleveland 15, Ohio. These plants are available in two sizes, 50 to 60 tons and 70 to 80 tons of hot mix per hour, and are designed for making cold mix without any changes, although the capacity in the latter case depends somewhat on the mixing cycle. A 4,000 and a 5,000-pound mixer are also described and illustrated, as well as double-deck vibrating screens, two types of driers, both internal-fire and the two-fire type, steam-jacketed asphalt buckets, and an improved adjustable mixer tooth.

Copies of this bulletin, No. 39, may be secured upon application to the manufacturer and mention of this item.

U. S. Marine Corps Photo
On Tarawa in the Pacific, a Seabee operating a Caterpillar diesel tractor with LeTourneau bulldozer fills in a Jap tank trap and covers barbed-wire entanglements.

For Your Post-War Files

Among the literature on various phases of post-war planning are the following, which supplement our previous suggestions for your post-war file (See C. & E. M., July, 1943, pg. 60; September, 1943, pg. 23; November, 1943, pg. 8; January, 1944, pg. 42; and April, 1944, pg. 76):

32. "War and Post-War Adjustment Policies", 108 pages, 9¼ x 6 inches: a report prepared by Bernard M. Baruch and John M. Hancock in which their recommendations to avoid a post-war depression are outlined. Copies may be secured from the Superintendent of Documents, Government Printing Office, Washington, D. C.

33. "Construction in the Postwar Economy", 10 pages, 11 x 8½ inches: a statement, with particular reference to action which Congress can take to insure a maximum volume of construction, presented to the Committee on Public Buildings and Grounds of the House of Representatives by Douglass Whitlock, President of the Producers' Council, Inc., and discussing construction's part in the post-war economy, estimated post-war construction, and the scope of Congressional action to insure a high level of construction after the war. Copies may be secured gratis from the Producers' Council, Inc., 815 Fifteenth St., N. W., Washington, D. C.

34. "How to Plan Now for Tomorrow", 8 pages, 10½ x 8 inches: a report prepared to aid building-product manufacturers in estimating the probable post-war demand for their products. Copies are available from the Producers' Council, Inc., 815 Fifteenth St., N. W., Washington, D. C.

35. "Speakers' Handbook—Post-War Highway Plan", 16 pages, 11 x 8½ inches: this is a handbook primarily for use in preparing speeches, although the material is also of value in general promotion of the ARBA post-war highway plan, as it contains not only helpful suggestions for speakers but also useful facts from the economic and highway studies on which the Postwar Highway Plan is based. Copies may be secured from the American Road Builders' Association, 1319 F St., N. W., Washington 4, D. C.

36. "Highway Transportation Post-War Needs", 21 pages, 11½ x 8¾ inches: an analysis of this subject by W. Foster Banks, President, Motor Haulage Co., Inc., and Chairman of the Highway Transportation Division Post-War Planning Committee of the Commerce and Industry Association of New York. Among his recommendations are the removal of all state trade barriers, the elimination of local "bottlenecks" on highways, and the construction of highways which will insure greater public safety with an increased volume of traffic. Copies are available gratis direct from the Commerce and Industry Association of New York, 233 Broadway, New York 7, N. Y.

37. "Post-War Planning Now", Spring 1944 Edition, 24 pages: another study by the New York *Journal of Commerce* of the actual peacetime outlook in fifty-six major industries, including construction, based on 286 reports from industrialists, government, and trade associations. Copies may be secured from the N. Y. Journal of Commerce, 63 Park Row, New York 15, N. Y., at 25 cents each.

38. "A Business Appraisal of Post-War Markets", 16 pages, 11 x 8½ inches: a manual of procedure on how your industry can cooperate with the Committee for Economic Development in attaining a high level of sales, production, and employment in the post-war period. Copies may be secured from the Committee for Economic Development, Field Development Division, 285 Madison Ave., New York 17, N. Y.

39. "The Engineer in the Post-War World", 88 pages, 9 x 6 inches: the speeches and addresses at the Public Conference in New York City last March. The subjects covered include the future of the engineer in the post-war world, the practical effects of a cheap supply of energy, and the post-war role of the engineer as seen by representatives of various sections of the world. Copies may be secured from the Research Bureau for Post-War Economics, 90 Morningside Drive, New York 27, N. Y. Price: $2.00.

Well-Run Garages Care For Navy Equipment

(*Continued from page* 11)

Alemite lubrication outfit, and, on the wall, a Kidde carbon-dioxide fire extinguisher and a soda-and-acid extinguisher.

The entrance to the garage at the front and back is through wide overhead doors. Along the side opposite the shop a 5-foot concrete curb has been constructed to permit backing the trucks in and at the same time, by limiting the backward movement, prevent damage to the rear of the truck or the wall of the garage. This virtually amounts to a sidewalk that is easily flushed and does not hold trash as would a narrow curb. The garage is heated by overhead unit heaters supplied with steam from a nearby power plant.

The Mainside Garage

The main garage is a brick structure 128 x 196 feet in plan with a new storage garage the same size alongside. The windows are glass block to furnish the maximum of light with the minimum of heat loss in winter. This being one of the older permanent buildings, it has steel trusses supporting the roof.

The chief dispatching office is located at the main garage from which the location and service of every piece of automotive equipment, as well as a flock of bicycles, are controlled. Here also is maintained the record of every piece of equipment by means of a card and visual board system so that the date of every prospective greasing and overhaul is known well in advance. Cars and trucks are greased every 1,000 miles and given a routine battery and tire check and oil change at the same time, while the vehicle is on the lift. Tires, gas and oil are checked every time the vehicles come into the garage after an assignment, to prevent any deterioration.

The value of this constant maintenance checking of vehicles is shown by the remarkably few failures of trucks on long and short hauls. There was but one major truck failure in over 20,000 truck-miles of service between the Station and Chicago during the past year and not more than ten major failures in over 3,500,000 truck-miles of operation within the Station and close-by sections.

Parts Department

The parts department is located conveniently in the repair-garage section of the main garage. The original equipment included steel bins for all parts and steel revolving bins for the numerous small items that move rapidly. With the expansion of the Station, the parts department was also enlarged but steel bins were out of the question so all new bins are of wood, built in the Station carpenter shop.

The check board for greasing and overhaul of trucks is kept up to the minute in the parts department office where the cards for each piece of equipment also are on file, showing every bit of work that has been done on it, with dates, mileage and requisition number. A perpetual inventory of all parts in stock is maintained, showing the status of each unit at the end of each transaction. A separate parts-storage section is provided on the second floor of the main garage for larger and heavier parts that do not move so rapidly.

Messenger service throughout the hundreds of acres of the Station is maintained through the main garage, where the fleet of bicycles, scooters and motorcycles is stored. Because every part of the Station is within five minutes' driving of the main garage, no spare tires are carried on any vehicles operating within the area. A flat simply means that the driver goes to the nearest telephone,

The Camp Porter Garage, one of the maintenance garages at the U. S. Naval Training Station, Great Lakes, Ill., has ample storage space and a small shop section shown at the left.

calls the main garage, and the service truck with experts to change the tire are on the job in about five minutes. This greatly increased the potential service of the stock of tires on hand when rubber became so critical.

The Shops

Down the south side of the main shop are a series of small sections designated as separate shops, each with its special equipment. First in the southeast corner is the bicycle shop where every manner of repair to these man-power vehicles is handled. Next along the south wall is the lawn-mower shop with metal-covered bench and vises, a lawn-mower sharpener, and a grinder for the back-knives.

Between the lawn-mower shop and the series of mechanics' benches that string down the south wall from this point is a Turco Emulso outfit for cleaning parts. The liquid is painted onto the parts with a hand brush and then the fluid and grease are washed off with cold water, leaving the part ready for repair after careful checking.

Each mechanic's bench has a locked drawer for his personal larger tools, the necessary machinists' vises, and plenty of elbow room. A Black & Decker valve-refacing tool is mounted on one of the benches. All reboring tools, portable cylinder grinders, universal grinders for the lathes, test gages, finishing hones, etc., are kept in the stock room and taken out by the mechanics of the main garage

(*Concluded on next page*)

Great Lakes Program Of Equipment Care

(*Continued from preceding page*)

or of any of the maintenance garages on requisition.

Additional equipment along the south wall includes an AC spark-plug cleaner, a Willey's electric buffer and grinder, an overhead chain falls running over the lift and to the bench for handling motors, and a floor-model Shurhit stroboscopic analyzer for all electrical tests on automotive equipment.

The machine-tool section is well equipped with a Hamilton 14-inch x 5-foot lathe with quick-change levers, a Canedy-Otto Royal drill press, a mechanical press built in the Station, a Greaves Klusman 16-inch x 5-foot lathe, a Rockford 28-inch drill press for 1¼-inch holes, another smaller heavy-duty drill press, a Manning Maxwell shaper, an Ohio milling machine, a Chicago brake riveter, a Racine power hack saw, an Allen Unitron fast charger which can also be used for regular slow charging, and a 5-kw Kohler electric plant mounted on a survey truck so that it can be transported to any part of the Station.

A separate ECO garage compressor is installed as a safety measure to supply the air for the air-oil lift for trucks. Two other compressors supply the garage needs, one a Westinghouse Air Brake compressor serving the paint shop, and the other a Gardner-Denver unit for tire inflation and cleaning parts.

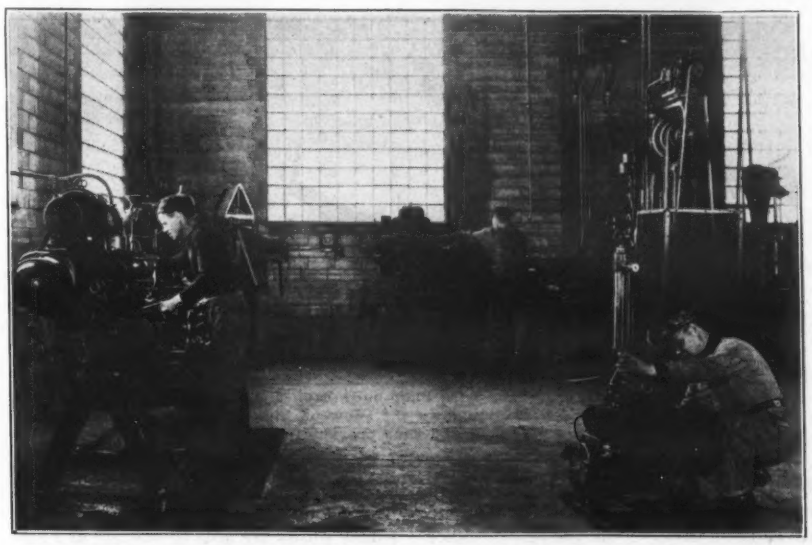
In a doorway along the north wall of the shop, between the entrance section and the shop section, is a Bear wheel aligner. Close by are the Bowser lubricant dispensing pumps, a sheet-metal box for the storage of wiping rags, and then at the northwest corner is the tire department with a tire expander, buffer, and patching outfit. An Allen Unitron battery unit of the slow-charging type is also installed here.

An addition to the garage was completed in January, 1942, with wood-arch trusses to support the wood roof. This new section, which is the same size as the older main garage, is used for the storage of diesel buses and for their overhaul and repair. It has a Rego gas welding outfit mounted on a hand truck with a reel for winding up the long gas hose to protect them from wear and damage. At the front of this storage section is a large wash rack where the buses are given a daily bath. In addition to the main entrance door at the front, there is a steel roller door at the rear which permits the Station's Plymouth gas switching locomotive to be garaged.

A brick lean-to outside the new section of the garage is used as a paint shop, with room for work on two trucks at the same time. The shop is equipped with DeVilbiss spray painting units and a DeVilbiss washer at the rear to remove vaporized paint from the air.

Snow-Removal Equipment

Inasmuch as the Station is in the snow belt, there is a fleet of snow-removal equipment which is operated under the direction of the Transportation Officer of the Station. This includes two patrol graders, one V-plow and one straight-blade plow for mounting on trucks, a V-type plow for sidewalk plowing, and bulldozers, amounting to a total of eleven pieces. These units plow the main roads at the Station and the main sidewalks. Sidewalks in the various camp areas are cleaned by hand, an outdoor variety of KP.



The machine shop in the Main Garage at the Great Lakes Naval Training Station

Personnel

The main garage and maintenance garages contribute to the efficient operation of all automotive equipment at the Great Lakes Naval Training Station, but the other shops all contribute their share to the replacement of any part which may wear out or be damaged in the operation of the equipment. This is in addition to the regular work of these shops in maintaining all plants throughout the Station. There is even a galley shop where the equipment and numerous "tools" used in a Navy galley are repaired and returned to the various mess halls.

This system of main garage and satellite garages is operated under the direction of the Public Works Officer, Capt. K. B. Bragg (CEC), USN, with Charles G. Filstead, a civilian, as Transportation Superintendent.

North Dakota Meets Deep-Snow Problem

(*Continued from page 29*)

3 to 4 miles an hour on this type of work. This winter streamlining reduces further drifting and is advantageous.

Snow fences are usually set 100 feet from the cut banks and generally on the north and west sides of the roads which is the direction of the prevailing winds. At the same time, in the early autumn when these snow fences are set, careful attention is given to the clearing of all brush and high weeds growing along the tops of cut banks, as even light vegetation in this location disturbs the wind currents and aggravates drifting.

After the early snowfall has covered the adjacent grounds, motor graders are used to create drifts in lines approximately 50 feet apart and roughly parallel to the center line. These drifts serve as auxiliary snow fences, forming still larger drifts which materially increase the snow storage off the traveled way, thereby eliminating much drifting on the highway.

Operations With Limited Forces

Drafting of experienced personnel for service in the armed forces as well as the loss to wartime industry has created a serious shortage of man-power in the Department so that it is impossible to operate all snow-removal equipment continuously during heavy storms. The heavier more effective equipment is operated continuously but, in order to make this possible, operators who are

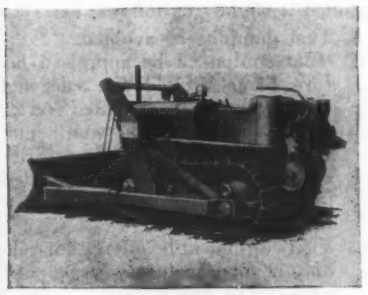
A Marmon-Herrington-Ford truck with shop-built back sloper is used by the North Dakota Highway Department to cut down the snow on high banks to streamline the highway cross section and thus prevent further drifting.

ordinarily used on lighter plows must be transferred as needed. Men and equipment are shifted from division to division on orders from the central office in an effort to open the most heavily traveled routes as promptly as possible. However, with the considerable mileage, much of which serves sparsely populated areas, delays are inevitable in re-opening some of these roads after an unusually heavy storm. In 6 to 7-foot drifts, the rotary plows are able to operate at a rate of only ½ to 1 mile per hour so many hours of operation may be required to open badly drifted roads.

The lighter high-speed equipment is usually operated in pairs as the knowledge that help is available in case of trouble gives the operators confidence and enables them to do a better and quicker job when this type of equipment can be used successfully.

Sanding is done by small motor-driven spreaders or by hand from stock-piles established at convenient locations during the autumn and is necessarily kept to a minimum by the shortage of man-power and the need for economy.

Another operation, which while not exactly a snow-removal problem is closely related, is the thawing of culverts which have been clogged by ice, in order to expedite the spring run-off. Portable Cleaver-Brooks car heaters are used for this purpose with the steam they generate delivered to the clogged culverts through steam hose and thawing nozzles made of ½-inch pipe. This operation, while requiring considerable expenditure of both money and man-power, is an essential part of the program and cannot be neglected nor materially reduced.



The new Buckeye cable-controlled side-lift bulldozer.

New Double-Trunnion Tiltdozer for HD-7

A new cable-controlled side-lift bulldozer and trailbuilder, featuring single king-pin mounting of the moldboard and double-trunnion tilting, has just been announced by the Buckeye Traction Ditcher Co., Findlay, Ohio. The moldboard of this trailbuilder can easily be angled to the right or left on the single king pin simply by removing two landside pins, swinging the blade to the desired side, and replacing the landside pins which hold it rigidly in place. The double-trunnion mounting makes it possible to tilt either end of the blade 12 inches by attaching one push arm to the top trunnion on one side while the other arm is mounted on the lower trunnion on the opposite side.

The horn and push frame, which have been completely redesigned, are fabricated from heavy steel welded box beams to provide maximum strength. The rugged construction of the moldboard is another feature of this new 'dozer. Welded V-shaped vertical braces and heavy steel plate horizontal cross pieces reinforce the blade so that it can withstand the toughest bulldozing operation. The moldboard is fitted with a reversible cutting edge and replaceable corner bits.

This new bulldozer is designed for mounting on the Allis-Chalmers HD-7 crawler tractor, with the weight evenly distributed over the crawler shoes to provide maximum traction. Single or double-drum Buckeye power control units provide the necessary power.

Further information on this new Buckeye 'dozer may be secured by those interested direct from the manufacturer.

Seeding and Mowing On Colorado Roads

Aside from roadside protection projects which have been built by Federal participation in Colorado, the Maintenance Department of the Colorado State Highway Department has done a considerable amount of seeding with its own funds and forces. On State Highway 14, for example, between Sterling and the state line in the northeast corner of the state, a common farm drill was rented to plant rye in the borrow pits and on the shoulder slopes for a distance of 58 miles. The first year, there was an excellent crop of rye and a fairly heavy volunteer crop in the two years succeeding. This prevented any appreciable erosion on this entire stretch of road and, by the time the rye had ceased to grow in any great amount, the natural grasses covered practically all of the borrow pits and slopes.

Of necessity, planting is varied according to the location. In the irrigated sections and in the mountain sections of considerable rainfall, that is on the west slopes of the mountains, it is not difficult to get vegetation started; but, in the dryland areas and areas of limited rainfall to the east of the mountains the natural growth is very slow in reestablishing itself on new construction.

It has been found by A. Walter Pesman, Landscape Architect for the Colorado State Highway Department, that yellow sweet clover is the most effective plant which can be used to stop erosion in the arid areas. He has seeded a number of sections with this clover and has also adopted a practice, when there has been a good growth of clover, of mowing it after it has gone to seed, then loading it on trucks and scattering it on slopes and in borrow pits to aid in the establishment of new growths.

In the past two years mowing operations have been curtailed, due to lack of man-power and equipment. It was the former practice in Colorado to keep the entire roadside mowed throughout the growing season. For the past two years, however, mowing has been confined to one cut on top and one cut down the slopes during the summer months, and only one mowing of the entire roadside area during the season, and that after the growing period has stopped.

Due to lack of equipment, it is now the practice, during the summer months, to operate the mowers 16 hours a day. The patrolman takes the mower for one shift, and his helper for the next shift. In this way it has been possible practically to double the amount of mowing done by each available machine.

Mr. Pesman furnishes some interesting cost figures on the rather extensive landscape projects which resulted at the outset of the roadside development program in Colorado. These required a great deal of maintenance and added much to the general maintenance costs of Colorado highways. These costs reached a peak of $18,664.64 in 1939. Now, due to the fact that these projects are becoming, to some extent, self-sustaining, the cost was reduced in 1943 to $5,134.94.

The practice of building extensive landscape projects which are expensive to maintain has been abandoned in late years, and the efforts of the Department are devoted to seeding and planting roadside areas and cut and fill slopes to prevent erosion, and decrease, rather than increase, maintenance costs.

Work for Contractors Is Developed by AGC

Efforts on Behalf of Contractors Reported at Meeting in Chicago: Wage Stabilization and Disposal of Surplus Equipment Discussed

✦ THE Spring Meeting of the Governing and Advisory Boards of The Associated General Contractors of America, held May 29 and 30 at the Drake Hotel, Chicago, Ill., explored new ways for general contractors to engage in war work, learned that the threatened requisitioning of equipment had been forestalled, strongly urged that the wage-stabilization program should be enforced, and gave careful consideration to the disposal of government-owned equipment at the end of the war.

President William Muirhead, Durham, N. C., opened the meeting on an optimistic note by predicting that, within a year after the end of the war, construction would be operating at the rate of $12,000,000,000 annually. Within five years after the termination of hostilities, the yearly total of construction should reach a rate of $20,000,000,000, he said.

H. E. Foreman, Managing Director, reported on work being done by the AGC in collaboration with the War Production Board in developing new war work for general contractors. In April, when the WPB was considering requisitioning contractors' equipment for building roads to new stands of timber, for coal stripping, and for certain petroleum operations, the AGC suggested that these were types of work for which the contractor was qualified better than anyone else, and that contractors should execute this work with their own equipment. Since that time, various divisions of the WPB, lumber and coal operators, and contractors have been cooperating to get necessary work done by general contractors. Thus, the threat of the requisitioning of contractors' equipment has been at least forestalled if not definitely ended, according to Mr. Foreman.

Resolutions Adopted

Two resolutions were adopted by the Boards, the first of which urged each AGC Chapter as follows:

1. To uphold actively and support the wage-stabilization program and the enforcement divisions thereof;
2. To cooperate voluntarily with the regional attorneys of the War Labor Board in the policing and elimination of all violations and to oppose actively the pressure exerted by any agency or individual towards payment of wages above the legal established rate;
3. To determine and make available to the contractor employers in the area the legal established rates;
4. If such present rates are not suitable, to determine promptly the practical wage scales for the construction industry in the area and to take the necessary steps for approval by the Wage Adjustment Board of such suitable wage scales.

The second resolution, on permissive area rates for all contractors, strongly urged that:

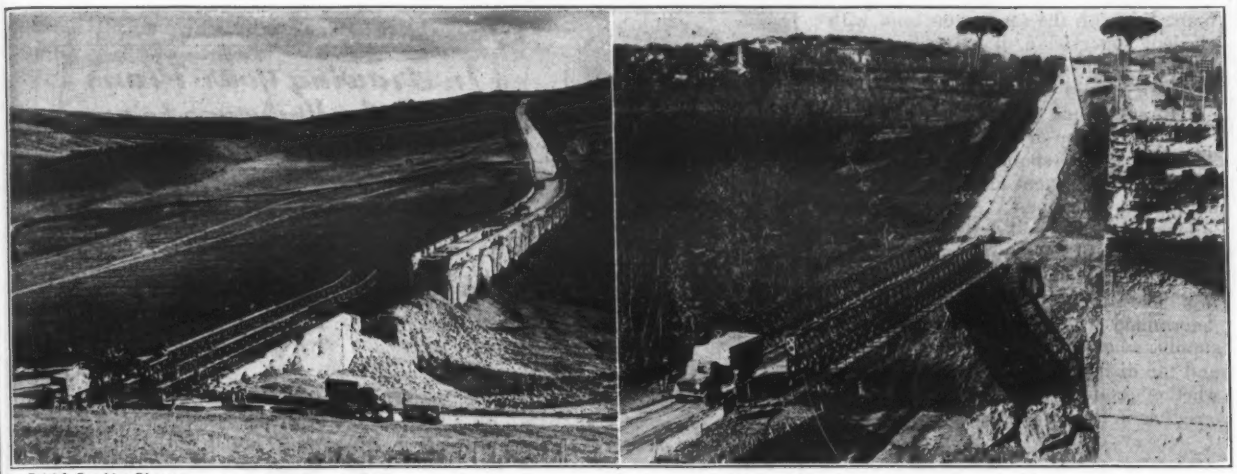
1. The War Labor Board and the Wage Adjustment Board seriously consider the setting up of a procedure whereby rates of pay for different classifications for each type of construction (building, highway, and heavy engineering) may be established for each clearly designated geographical area in accordance with present practice and custom in the construction industry.
2. These rates so determined shall be the ceiling limits that can be paid by any construction employer for such classifications of labor and type of construction in that area; and further, where lower rates have been paid these rates may be adjusted upwards to not more than said ceiling rates, without prior approval by the Wage Adjustment Board.

After thorough discussion of the disposal of surplus government-owned material and equipment at the end of the war, the Boards reaffirmed a resolution adopted on this subject at the Twenty-Fifth Annual Meeting in February, and amended it slightly as follows:

A. That dumping be avoided.
B. That equipment be appraised before being offered for sale and that none be distributed on a gratis basis within the continental United States, and that no priority or preferential price be extended to state governments or their political subdivisions.
C. That equipment be offered for sale only to manufacturers, recognized dealers and distributors.
D. That distribution be made by the government agencies owning or having control of the equipment.

Post-War Flood Control

Flood-control plans should be given first consideration in the post-war economy, Senator James J. Davis of Pennsylvania recently stated, to reclaim useless swamp and lowlands, provide irrigation and water for drinking and industry, and contribute to recreational facilities as well as prevent flood damage.



British Combine Photos

The Bailey Bridge, invented by D. C. Bailey of the British Ministry of Supply, consists of parts made in both Britain and the U. S., and provides great strength where heavy bridges are needed. Left, Royal Engineers erecting a Bailey Bridge in Italy, showing the structure just before launching the nose. At right, a Bailey Bridge on the Fifth Army front in Italy.

Care and Operation Of Rotary Snow Plows

In its Catalog No. 42, the Snow Removal Equipment Co. points out that its Rotoblade rotary snow plow is built to remove a lot of snow, and not as a plaything. While few of our readers or their employees regard snow-plowing as a kind of game, in these days of limited and inexperienced help, it is extremely important that all operators of snow-plow equipment understand the proper operation of the equipment entrusted to them, in order to keep it doing its job of plowing snow.

This company reports that the principal source of trouble it has found resulting from improper operation is that operators permit the front end of the truck to ride on the plow, instead of the plow's being supported by the truck, thus causing unnecessary wear on the shoe wearing plates. The correct method is to elevate the plow by means of the hoist provided, so that most of the load is taken by the truck and the plow shoes just skim the road surface. This care will add considerable life to the wearing shoes and cutting edge, and is simply a matter of the operator's taking ordinary precaution.

One of the wearing parts of Rotoblades is the rotor vanes, which just wear out naturally from usage. The manufacturer suggests for a season's operation two sets of rotor vanes, three cutting edges, three left-hand shoes and three right-hand shoes. Now is the time to check up on your plows and be sure that a sufficient supply of necessary parts is available. If not, start immediately to secure them; don't wait until your plow breaks down next winter and then expect the manufacturer to rush your needed parts to you in a hurry. In these days, that just can't be done.

As in the case of all machines, regular and proper lubrication is extremely important to the efficient operation of the unit. The points on a Rotoblade which must be checked and lubricated are the V-8 100-hp engine which powers the rotor unit; the Ford transmission, in which the oil should be changed and the transmission washed out every hundred hours of actual running time; and the chain transmission from the engine to the rotor.

The manufacturer of Rotoblades suggests that, before going out on a job, the following check be made. Be sure the governor is at 2,800 rpm (in gear and rotor running); check all radiator hose connections; recheck the oil level in the engine and the roller chain housing; check the carburetor setting, as too lean a mixture will tend to burn the exhaust valves; and, very important, check the lifting arm. This is done with the plow setting on the ground by removing the plug at the base of the ram and working the pump handle until all air is out of the hose. Then screw the plug in tight.

Copies of this Rotoblade instruction manual, Catalog No. 42, containing complete and detailed instructions on the installation, operation and care of Rotoblade rotary snow plows, with diagrams and photos to supplement the text, may be secured by those interested direct from the Snow Removal Equipment Co., 400 Seventh St., San Francisco, Calif., by referring to this item. Don't put off getting your snow-removal equipment all set for winter. After the snow flies it's too late, and this winter particularly it is essential that all available equipment be ready to meet any emergency.

Join the Big Push! Buy more Bonds!

Hints for Planning Large Sodding Jobs

(*Continued from page 53*)

has been completed. Another method is to broadcast the seed with a "seed and fertilizer spreader" and to spread the topsoil as a final operation. The writer has secured equally good results by spreading the seed before watering. In this way, the watering washes the seed into the surface soil. With such a procedure, topsoil is not really essential.

Watering

The conditions of the soil, daily temperatures, and the prevailing rainfall are all determining factors in watering operations. Watering is costly and, unless essential to establish the turf, may be omitted. However, if sodding is done during the heat of the summer, watering equipment must be available because one can never anticipate, from one day to another, when watering will be demanded.

Equipment

The most important piece of equipment for extensive sod-cutting operations is the sod cutter. Several types are on the market, ranging in price from $40 to $2,000. The simpler kinds are of the modified sled type with flattened U-shape blade, cutting one, two, or three strips at a time, and are pulled behind a truck or tractor. This type is seldom satisfactory for heavy and extensive work. A second type uses a V-blade, drawn beneath the sod like a plowshare on a plowbeam, mounted on an axle and heavy roller wheels. Ahead of the blade is a wheel colter and width gage. By means of different blades and also by means of different adjustments in the gage, the width of the sod strip can be varied. There is also an adjustment determining the thickness of the sod. Most operators fabricate their own cutter, adapting it to the needs of the work.

A cutter, equipped with a 45-hp tractor motor, selling for $2,000 to $2,500 has been produced commercially and will again be put on the market after priorities have been abandoned. This machine operates under its own power, is rubber-tired, moves at a rate of 5 to 6 miles per hour, and is equipped with a hydraulic hoist for raising and lowering the blade. The cutting bar is 24 inches long, moving at a variable depth beneath the sod. It is actuated by a cam, producing a reciprocating horizontal motion at right angles to the direction the machine is traveling. The short heavy blade is similar in design to the sickle of a farm mower but is built of much heavier material and moves at slower speed. This sod cutter must have good conditions under which to operate, level ground, no stone, and a fairly dry surface for traction.

In addition to the sod cutter, the following equipment should be available: (1) A good farm tractor of 25-hp or more, (2) three or more flat-bed trucks, depending upon the distance the sod must be hauled, (3) one tandem disk, (4) one spike harrow, (5) one hand seeder and fertilizer spreader, (6) one pick-up or panel truck, (7) one or more tank trucks of 2,000 to 3,000-gallon capacity, equipped with pressure pump and hose, (8) one roller, 2 to 5-ton, depending on the nature of the soil, and (9) miscellaneous hand tools.

Working Organization

The time when the sodding job must be completed determines in part the number of men required. A crew of twelve to fifteen should lay 1,200 to 1,500 yards a day. A good average is 10 yards per man-hour. If the cutting end does not function properly, this can readily drop down to 7 yards per man-hour, but with the same crew, and with efficient supervision, it may be stepped up to 12 yards per man-hour.

There should be one superintendent, one foreman, one tractor driver, one sod cutter, and three or more truck drivers. The above list should include a mechanic with sufficient ability to keep the equipment in shape.

During the hot and dry seasons, there must be added to the above one or two tank-truck drivers to attend to the watering. The number of tanks used will be determined by the source of the water supply, whether stream or fire hydrant, and the distribution of the sodded area, whether consolidated or widely scattered, as in the case of inlets.

Sodding Data

On all state and Federal work, the superintendent is usually required to furnish the government inspector with daily reports on three items: equipment used, personnel and number of men employed, and the quantity of sod in place.

(*Concluded on next page*)

Time Analyses Made On Sodding Projects

(*Continued from preceding page*)

If the sod which is brought in is measured on the project, daily records and maps must be kept showing the source of the sod.

The man-hours involved in various sodding operations on three different projects, each involving large-scale sodding (data having been tabulated while the work was in progress), are shown below:

DETAILED TIME ANALYSIS OF SODDING OPERATIONS ON THREE DIFFERENT SODDING PROJECTS

FACTUAL DATA	SODDING PROJECTS "A" Aug. 23-Sept. 30	"B" Oct. 28-Dec. 4	"C" Oct. 1-Oct. 31
1. Sq. yds. sodded on project	30,400	30,800	39,200
2. Duration of job (days)	39	37	30
3. Days worked	35	35	26
4. Man-hours per day	141.4	108.5	117.0
5. Average sq. yds. per day	868.6	880	1,508
6. Average hours per day	10	9.04	9
7. Average no. of men per day	14.1	12	13
8. Total hrs. worked—labor & mechanic	4,950	3,798	3,042
9. Average sq. yds. per man-hr.	6.15	8.10	12.22
10. Supt. & Engr. hrs.	390	540	300
11. Average sq. yds. per man-hr. (incl. Item 10)	5.70	7.10	11.72
PRODUCTION OF SOD			
Number of men (cutting-sectioning-putting into rolls-loading)	5	6	7
1 tractor operator	350	329	234
4-5* laborers	1,400	1,316	1,170*
1 laborer-truck driver	50	50	234
1 mechanic as laborer	240	185	—
Total	2,040	1,880	1,638
DELIVERY OF SOD			
Number of men	1	1	1
Man-hours (driving truck)	140	389	260
" " (driver loading)	50	50	0
" " (driver unloading)	160	214	0
Loads	280	310	262
Square yards per load	115-125	90-110	150-160
Average haul (miles)	0.75	5.5	10
PLACING SOD			
Number of men	7	4	5
Preparation of ground and salvage (man-hrs.)	600	294	25
Unloading and laying	1,610	1,170	1,077
Watering	400	38	20
Rolling (hand)	160	26	0
Rolling (power)	0	22	28
POWER EQUIPMENT HOURS			
Tractor	390	370	0
Power sod cutter	0	0	270
Trucks	*780	**1,100	**810
Tank trucks	400	38	20
Panel truck	426	426	0
Pick-up truck	200	40	260
SUMMARY: TOTAL NO. OF HOURS			
PRODUCTION OF SOD	2,040	1,880	1,630
TOTAL MAN-HOURS—Hauling	140	386	262
TOTAL MAN-HOURS—Placing	2,770	1,529	1,150
PERCENTAGE OF TIME LOST (rain, breakdowns, etc.)	10.2	5.4	13.3
TOTAL SUPERINTENDENCE TIME (in percentage)	7.3	12.4	8.98

* 2 trucks used
** 3 trucks used

The data provided above show extreme rather than average conditions on airport sodding projects. Highly favorable, as well as adverse, conditions create the wide spread in some of the figures. "A" and "B" show extreme seasonal difference; heat and drought in August and cold and rain in November. Both employed, of necessity, transient labor with a high rate of turnover and absenteeism. "C" shows the advantage of stable labor and the occasional advantage of nepotism, for the efficient truck driver proved to be the nephew of the contractor.

The using agency and the inspector at "A" demanded a high degree of finish, close joints, hand rolling, and tamping at the edge of the concrete. The weather necessitated heavy watering both before the sod was cut and after it was placed. Some areas were watered every other day for a week. The inspectors at "B" and "C" were most tolerant, allowing a 2-inch space at the joints, a 5-ton roller, and required little or no preparation of the soil before the sod was placed. The weather was most propitious; cool nights and days, and plenty of soil moisture.

Field "A" had only two large areas to sod. Nearly one half of the area consisted of ten small soddings of 900 square yards each or less, and 76 inlets requiring only 56 square yards each. Scattered as they were, watering became a difficult problem. Field "B" consisted of two very large areas, 50 to 100 feet wide, adjacent to the new apron, and four inlets and four small areas of 1,000 square yards each. Field "C" had the most favorable areas. There were no inlets, only four narrow strips. The plans called for two 15-foot strips, adjacent to the concrete, for two new runways. The sod for "C" was of unusually high quality, from a ten-year-old hay meadow, and a clay loam soil.

The data also show the great advantage of uniformly cut pieces of sod, each 24 inches wide and 4 feet long and 1½ inches thick. The speed with which such rolls of sod can be placed is really phenomenal. The uniformity of the sod was due largely to the skill of the operator and the type of cutter used, which was positive in its action and had a capacity of 250 square yards per hour.

A further requirement in the sodding operation was used at field "A". All of the sodded areas, as well as the area from which the sod was taken, were reseeded. The sod was furnished by the using agency and taken from the airport field. The runways of both "A" and "B" were open to use. This, of necessity, slowed up the work. Only small loads, 90 to 110 yards, were possible, due to the rough roads traveled. At field "C", the sod meadow was adjacent to a concrete highway and 150 to 160-yard loads were feasible. Three trucks were employed on the "C" project. Only one driver was necessary to shuttle the trucks back and forth.

The satisfactions which are derived through good workmanship and excellent finish in sodding are well worth while. The contractor feels deeply repaid when the job is well done; the using agency feels that the life and efficiency of the planes will be greatly increased; and, to the visitors and personnel of the field, nothing is more obvious than the effectiveness of a fine sodding job, which is reflected in the higher morale of those using the field.

Typical War Jobs Shown In New Thew Brochure

The saga of Lorain shovels in the war effort is graphically told in a new brochure showing lifting, excavating and hauling jobs on a widespread front from London to the Pacific and from Cassino to the Aleutians. The photographs are excellent and the running comment tells an interesting story of the part Thew construction equipment is playing in clearing away debris in bombed towns, building bases and roads, salvaging battleships, and transporting equipment and guns on many battlefronts. The book ends with a strong recommendation to plan now for the days ahead when this and similar equipment can be used to repair the ravages of war abroad and return to the peacetime job of rebuilding our war-weary facilities at home.

Copies of this brochure may be secured upon application on your official letterhead to the Thew Shovel Co., 28th St. & Fulton Road, Lorain, Ohio.

Construction Industry And Wage-Hour Order

(*Continued from page* 18)

However, the original construction of a pumping station for flood-control units would not be covered unless such flood control was connected with the improvement of navigable rivers.

All employees of governments, Federal, state, county or municipal, are excluded from coverage under the Act, but an employee of a contractor doing work for a government body would be entitled to the benefits of the Act if engaged in covered work.

Under the terms of the Act, it is the specific work done by the employee which determines coverage, not the wider scope of the employer's activities. For instance:

1. Employees of contractors engaged in the construction or repair of such structures as homes, apartments, churches, or schools, which are not used for interstate commerce or the production of goods for interstate commerce are not covered by the Fair Labor Standards Act, except that

2. Employees who procure or receive materials coming directly from another state or are engaged in interstate transportation of materials or other forms of interstate commerce are covered by the Act.

3. Construction employees of a contractor who performs work in several states would not be covered for this reason, if they would not be covered otherwise.

4. Employees of contractors engaged in maintaining, repairing or reconstructing facilities or buildings which are instrumentalities of interstate commerce, or which are used to produce goods for interstate commerce are within coverage of the Act, including all field employees engaged on such projects, office workers, timekeepers and draftsmen.

5. The erection of additional facilities to an old building used to produce goods for interstate commerce is generally held to be outside the Act's coverage when there is complete physical segregation of the new building from the old. This would be the case even where, functionally, the new building is to be an integral part of the company's physical equipment and of equal importance with the old building in the conduct of the company's business. In following out this interpretation, the Division has held that the rebuilding of a plant, which has been largely destroyed by fire and been abandoned for some time, is not "reconstruction" but "original construction".

Interstate Commerce

In connection with No. 2 above, it should be understood that employees who are engaged in transporting materials across state lines will themselves be covered by the Act, even though such materials will be used on a project by construction workers who are not themselves covered by the law. Despite No. 3, employees in the office of a New York contractor who is engaged in work being done in New Jersey would be covered if they order, purchase or receive materials from outside the state. Likewise, the Act applies to draftsmen or office employees who prepare plans or drawings or records destined to leave the state in which they work; timekeepers and pay clerks who keep time records and make pay rolls for employees who are subject to the Act; and all employees who effect the shipment of materials or equipment to the site from any point outside the state. In this same category are watchmen who guard materials moving in interstate commerce.

It should not be inferred that in order that coverage may be established the plant must necessarily be in production at the precise moment that such activities are carried on. If an ordnance plant is shut down after the war in order that necessary repairs may be conveniently made for the purpose of opening up the plant again for the production of ash cans, the repair work is within the coverage of the Act even though it is performed on a building not presently being used to produce goods for commerce. If, however, an ordnance plant is shut down and then converted into a super-market, employees engaged in the repair and reconstruction work will not be within coverage of the Act since the building will not be used in the production of goods for commerce.

The question of applicability of the Fair Labor Standards Act to original construction of "essential instrumentalities of commerce" is still open to interpretation by the courts, and the Division has, accordingly, taken no position on this question. This means that the Division does not enforce the Act in cases involving such original construction. However, the maintaining, repairing or reconstruction of such instrumentalities of commerce as railroads, highways, bridges, pipe lines, telephone exchanges and transmission lines, wharves, docks and navigable waters of the United States are held to be activities in interstate commerce and subject to the Act.

Good lubricants properly selected and used regularly will keep your construction and maintenance equipment on the job until Victory.

The new Utility saw rig with foot pedal control.

Foot Pedal Control On Portable Saw Rig

The swing cut feature on the new Utility saw rig announced by Marvel Equipment Manufacturers, Inc., 224 South Michigan Ave., Chicago 4, Ill., is operated by a foot pedal, thus leaving both of the operator's hands free to handle the material. This increases the speed and accuracy of the saw rig, a factor which will be of interest to contractors using such a rig on production jobs such as concrete form work.

The swing feature operated by the foot automatically pulls the saw through the materials instead of pushing the material to meet the saw. Complete information regarding this new rig, including its price, may be secured direct from the manufacturer by mentioning CONTRACTORS AND ENGINEERS MONTHLY.

New Coated Electrode For Various Services

A new coated aluminum-bronze electrode of the shielded arc type, but which can also be used as a filler rod in carbon arc welding, has been announced by the Wilson Welder & Metals Co., 60 East 42nd St., New York 17, N. Y. Made of high tensile bronze, this Wilson No. 200 electrode is said to produce welding deposits possessing great strength and good ductility as well as resistance to corrosion. It is applicable in the welding of most bronzes, malleable and cast iron or steel, and meets the strict requirements for welding manganese bronze conforming to Federal Specifications QQ-B-726b or Navy Specifications 49-B-3e. It can also be used for welding dissimilar metals such as cast iron to brass, steel to malleable iron, or any two metals which are weldable with aluminum-bronze.

Wilson No. 200 electrodes are made in stock sizes of 1/8 to 3/16 inch in the 14-inch length, and 1/4 inch in the 18-inch length; sizes 5/16 to 1/2 inch in the 18-inch length may be obtained on special order. Additional information regarding the new electrode may be secured by writing direct to any of the manufacturer's offices. Just mention this item.

Vibratory Feeders Have Rheostat-Controlled Flow

A line of vibratory feeders, equipped with dial rheostats to regulate the flow or feed of material, is described and illustrated in a four-page folder issued by the Syntron Co., 227 Lexington Ave., Homer City, Pa. Vibrated by electromagnets, these Vibra-Flow units are reported to be simple in construction, having no wearing or mechanical parts such as gears, cams, motors or bearings, to require replacement or maintenance, and are available in sizes capable of handling up to 1,200 tons per hour of rock, slag and similar material. In addition to descriptions and illustrations of several models, the catalog contains a number of photographs showing these units in operation on a variety of jobs.

Copies of the folder "Save with Syntron" may be secured upon application to the manufacturer.

Wartime Maintenance On Penna. Highways

(*Continued from page 2*)

All Employees On Salary

On January 1, 1944, the Pennsylvania Department of Highways placed the maintenance employees in practically all counties on a salary basis. The wage rates were fixed as follows:

Foremen	$155.00 per month
Caretakers	143.00 " "
Equipment operators (of heavy equipment)	155.00 " "
Equipment operators (of light trucks)	143.00 " "
Skilled labor	143.00 " "
Garage foremen	189.00 " "
Mechanics	$143.00 and 155.00 " "
Common labor	110.00 " "

These rates provide an increase over the hourly wages formerly paid. The principal advantage of placing employees on a salary basis was the fact that they are assured of stability of employment and of annual income, with the additional advantages of vacations and membership in the State Employees Retirement System.

While the salary system has been in effect only seven months, it has met with universal approval. Even though the men are not paid overtime for emergency work, no difficulties were encountered in instances where it was necessary for them to work considerable overtime on snow removal and surface-treatment operations. Furthermore, the overall efficiency has been improved since there is no advantage to be gained by the employee in making the job last and working overtime, because he does not receive overtime pay, and is assured of his regular salary regardless of the type of work he is doing.

Maintenance Activities

Despite the difficulties encountered in obtaining sufficient personnel, the Pennsylvania Department of Highways has been able to keep its highway system up to an acceptable standard. All of the roads have been maintained in type, except for less than 100 miles which have deteriorated because of excessively heavy loads being hauled over them. These roads were designed only for light local traffic and were never intended to carry the loads now imposed upon them.

This Department of Highways has never found it necessary to contract maintenance and, because of the large mileage and varied types of work involved, we believe that this can be more expeditiously and economically performed by Department forces. Our ordinary maintenance consists primarily of maintaining surfaces; drainage, including berms; roadside structures; and traffic service, such as guard rail, signs, markers, etc.

The principal item of special maintenance in 1943, due to war emergencies, was placing approximately 125,000 square yards of concrete patching at a cost of about $1,000,000. This work was carefully planned. The District Engineers and the County Maintenance Superintendents made a careful inspection of all concrete roads and listed the areas where concrete patching was required and could be justified. This type of patching was undertaken only on those roads whose usefulness could be continued by this expenditure. The work was performed by the County Maintenance Superintendents' organizations.

Particular attention has been given to sealing joints and cracks in concrete pavements. An 85-100-penetration asphalt, containing mineral flour, is used for this purpose. We have found that there is considerable advantage in checking concrete pavements at least once a month and sealing all joints and cracks which are open.

The considerable increase in the number of "pumping" points on our concrete pavements has been corrected by Mud-Jacking. A slurry consisting of earth and portland cement is pumped through holes drilled in the pavements, and sufficient material is placed to stabilize the area immediately under the joint.

Emphasis has been placed on patching bituminous roads. An RC-2 asphalt or an RTCB-6 grade of tar is used for this work. This bituminous material is mixed on the site with ¾-inch or ½-inch aggregate (stone, slag or gravel), using 12 to 15 gallons of bituminous material per ton of aggregate. Where considerable patching is to be done, concrete mixers are used to prepare the patching material which is then stockpiled for several days and placed as required. Where commercial plants are available, premixed patching material is purchased.

Base failures and drainage are corrected where necessary before the surface patch is placed. Ordinarily, patching is done by crews of approximately four men and, in these instances, the patches are hand-tamped. Where the operation is of sufficient size to justify a larger crew, about twenty men with trucks and power rollers are used. Considerable skin patching is also done. This consists of painting the bituminous surface with bituminous patching material and covering it with ½-inch aggregate. This seals the surface and eliminates the necessity of deep patching later.

Where the existing road is showing signs of deterioration, it is resurfaced. When concrete pavements have scaled or show signs of failure, 2 inches of bituminous concrete is placed after the disintegrated pavement has been replaced with concrete patches. Where bituminous pavements have deteriorated, it is resurfaced by adding approximately 4 inches of base material and a new bituminous surface course, usually consisting of a 1 or 2-inch penetration-type surface. If the width of the road is obviously not adequate to meet traffic demands, the pavement is widened along with the resurfacing operation. Usually a stone base is used for the widening and the resurfacing is extended over the new base of the widening strip. Resurfacing is carried out only in those cases where the existing pavement will not adequately accommodate traffic and where the existing pavement will provide a suitable base for the new surface.

Surface Treatment

The most expensive maintenance item on bituminous roads is surface treat-

(*Concluded on next page*)

Maintenance Costs Rise in Pennsylvania

(*Continued from preceding page*)

ment. In 1943, surface treatment was placed on 4,084 miles of bituminous pavements at a cost of $3,575,000. The types of treatment used were as follows:

Treatment Type	Bituminous Material Kind	Rate
No. 1	RC-3 or RT-5 or 6	0.25 to 0.35 gals.
No. 2	200-300 pen., or RT-8 or 9	0.25 to 0.40 gals.
No. 3	RC-3 or RT-5 or 6	0.65 to 0.80 gals.

Treatment Type	Aggregate Size	Rate
No. 1	½-inch	15-20 lbs.
No. 2	½ or ¾-inch	25-30 lbs.
No. 3	¾-inch	40 lbs.
	½-inch	15-20 lbs.

The application of bituminous material for surface treatment is contracted for and the Department of Highways furnishes the necessary labor and equipment required for placing and rolling the aggregate. Surface-treatment crews, consisting of a foreman, a timekeeper, an oiling inspector, and approximately sixteen men, with one or two distributors, seven or eight trucks equipped with spreaders, a mechanical loader or crane, and two or three rollers, place from 5,000 to 10,000 gallons of bituminous material and 250 to 450 tons of aggregate per day. This provides surface treatment of from 1¼ to 4 miles of road.

Bridge Maintenance

Bridge maintenance is handled mainly by Department forces. There are approximately 17,300 bridges on the state highway system in Pennsylvania, and in order to keep these structures in the best possible condition, each County Maintenance Superintendent is required to make an inspection of all the bridges in his county at least once a year. Where a deficiency is noted that cannot or need not be repaired immediately, more frequent inspections are made.

When repairs are required, the District Bridge Engineer assists the County Maintenance Superintendent in determining the repairs to be made and in preparing the necessary estimates. After the work is authorized, it is prosecuted by the county maintenance forces. Difficulties in obtaining materials for bridges have required that considerable attention be given to this work. When repairs to the superstructure are needed, salvaged steel has been used. In some cases, where short spans are involved, bridge decks have been replaced with laminated planks laid longitudinally. Where new floors only are required, laminated floors of 2 x 4 or 2 x 6 lumber are used. We have been wholly dependent on the use of lumber and salvaged steel for bridge repairs and, as a result, have confined this work to those cases where the usefulness of the bridge could not be continued for another year or so without repairs. This procedure will necessarily result in a large program of bridge maintenance in the post-war period. For bridge painting, we have abandoned the use of aluminum paint for the duration, and have been able to obtain sufficient lead-base paint for our requirements.

Bridge repairs costing less than $350 are financed from the general maintenance allocations made to the several counties. Where the cost of repairs exceeds $350, a special authorization for major repairs is made. In 1942, major repairs were made to 533 bridges; in 1943, to 429 structures.

Maintenance Costs

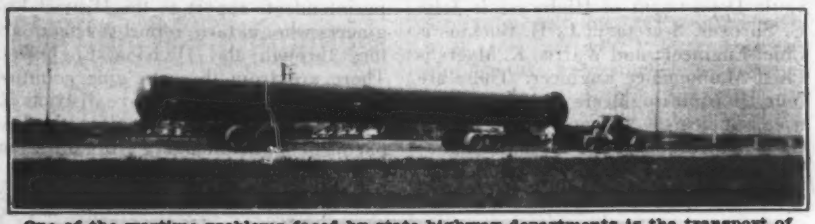
Since new construction and reconstruction of roads cannot be carried on at the normal rate or at a rate sufficient to replace worn-out facilities, the costs as well as the problem of maintenance have increased.

In 1942, Pennsylvania spent $16,500,000 for maintenance and snow removal, and approximately $1,000,000 for resurfacing. In 1943, maintenance and snow-removal costs amounted to $20,600,000 and $1,500,000 was spent for resurfacing. This represents a 25 per cent increase over 1942 costs. In 1944, it is estimated that $22,000,000 will be required for maintenance and snow removal, and approximately $6,000,000 will be expended for resurfacing.

In 1943, the Department of Highways used approximately 20,000,000 gallons of various grades and kinds of bituminous materials. Of this amount, 16,000,000 gallons were used for the retreatment of bituminous roads, and about 4,000,000 gallons for patching bituminous roads. Approximately 1,300,000 tons of aggregates were used in maintenance activities. In addition to this, approximately 143,000 tons of premixed bituminous materials (hot-mix cold-laid) were purchased for resurfacing and maintenance patching.

Organization

The Executive Head of the Pennsylvania Department of Highways is John U. Shroyer, Secretary; C. H. Buckius is Chief Engineer; and Warren K. Myers is Chief Maintenance Engineer. There are four Division Engineers and eleven District Engineers. A County Superintendent is in direct charge of the maintenance work in each county. These County Superintendents report to the District Engineers who, in turn, report to headquarters through the Division Engineers. There are from three to nine counties in a district and two or three districts in a division. At the present time, the Department's maintenance organization consists of approximately 7,000 men.



One of the wartime problems faced by state highway departments is the transport of "unusual" loads over the highways. This 110-foot-long 105,000-pound steel tower was moved without incident 15 miles over Texas roads.

Oversize Load Moved Over Texas Highway

Wartime requirements for the speedy construction of a high-octane gasoline plant "somewhere in Texas" necessitated the movement of a prefabricated cracking tower over a distance of 15 miles. Occasioning considerable worry and concern in the State Highway Department when request was made for permission to move this excessively long load, a route and time were finally worked out which avoided sharp turns and bridges designed for lighter loads.

This steel tower, which was 8 feet in diameter and 110 feet long, weighed 105,000 pounds. Mounted with one end on a low float semi-trailer and with the other end on a 2-axle bolster, the load acted as its own coupling pole. Evenly distributed on the sixteen tires, mounted on four axles, this load did not overstress any structures crossed, and was moved without incident or serious hindrance to traffic.

Gasoline and oil power the attack and are essential to winning the war. Use yours wisely; don't waste them!

Use of Natural Cement In Batching Concrete

That the substitution of natural cement for part of the portland cement in concrete improves its workability, reduces bleeding, makes the concrete tougher, less brittle, and produces other advantageous results is the thesis of a brochure prepared by the Louisville Cement Co., with the recommendation that natural cement be used to replace as much as 25 per cent of the portland cement. The brochure is composed largely of photographs showing both portland and blended-cement concrete after various tests for strength, acid resistance, durability under freezing and thawing conditions, fatigue resistance, et cetera, some of which were conducted by the Engineering Experiment Station at Purdue University. In each instance, the exact proportions employed and results obtained are tabulated. In conclusion the brochure reproduces several letters from contractors reporting on the use of natural cement and lists other jobs where it was employed.

Interested contractors and highway engineers may secure copies of this brochure by writing direct to the Louisville Cement Co., Speed Bldg., Louisville, Ky., and mentioning this review.

After the hangar arch is erected, it is securely bolted to the base plates.

New Steel Hangar

(*Continued from page 37*)

nearby sewer manhole.

Arch Rings

All material for the arch rings comes in nested form in light compact bundles with a maximum length of 17 feet. This facilitates transportation so that they may be used at forward air bases. The cubage is so small that the total storage or shipping space is approximately that of one 50-foot railroad box car.

Except for the end sections of each arch ring, all of the chords or segments are identical and interchangeable. The top and bottom-chord channels are connected by short lattice diagonals, bolted in place. The arch segments are then laid out to a circular shape and bolted together with the end sections hinged to the base plates, ready for raising.

Wind bracing is provided in each end bay by means of horizontal struts at each chord point and crossed diagonal tie-rods. All other bays are stiffened by four horizontal struts, in addition to the considerable rigidity afforded by the roof panels. One-inch-diameter tie-rods extend between the two ends of each arch under the floor.

The Covering Material

Steelox roof panels of 20-gage steel, such as have been used in frameless steel building construction, are used to cover the bays between the arch rings. These panels are interlocked and then bolted to the flange of the top chord of the arch ring.

These Steelox panels of "paintgrip" (without sheen) galvanized material are ordinarily the finished roof and are left unpainted but can be camouflaged. For the Washington installation, the plan is to cover it with a 1-inch rigid insulating board. Roofing paper built up to four thicknesses will then be applied over all.

The ends of the hangar, including the doors, consist of Steelox panels. Excepting for the doors, which are of double Steelox construction and hence do not need insulating, ½-inch insulating board will be placed on the inside. The lean-tos will be finished similarly and insulated on the inside. Helix nails 1½ inches long are used for applying the insulating board to the Steelox.

Construction

Of special interest is the small amount of equipment needed to assemble and erect the hangar. A 1½-ton truck with a stiffleg derrick aided in loading material for removal from the freight cars to the storage yard. This same truck served to shift the two 40-foot gin poles after each arch ring was hoisted. A 2-ton trailer truck was used a short time for hauling the roof panels to the storage yard. A winch truck was hired for raising the arches. Aside from this, about the only equipment consisted of wrenches, ropes, block falls and some ¼-inch cable.

Assembling of the arch segments was carried on by a crew of about ten men while the footings were being poured. Anchor bolts were placed in the footings and later the corrugated base plates were set and leveled up on a course of mortar.

As an experiment, the first two arches were raised by means of a crane with a 60-foot boom. The remaining arch rings were hoisted by the winch truck, with a double hitch passing over the two pivoted gin poles and then attached to the quarter points of the arch. A single arch could be lifted in about 15 minutes. Preparing to raise the next arch required about 1½ hours. A crew of about eighteen men was used.

Personnel

The U. S. Corps of Engineers did the grading, base stabilization, building the concrete footings and paving the floor, using their own forces. Col. John M. Johnson is the District Engineer for the U. S. Engineers; Lt. Col. P. C. Dorr is the Contracting Officer; and Major George H. Christensen was the Resident Engineer on this project.

A contract was let for assembling and erecting the hangar, doors, roofing, insulation and lean-tos to the Construction Division of Armco Drainage & Metal Products, Inc., Middletown, Ohio. C. H. Anderson supervised the job, with H. R. Bigler in immediate charge of construction.

Soft Sheaves Waste Essential Material

For Most Installations Hard-Metal Wheels Have Longer Service Life And Conserve Wire Rope

By WILLIAM SIBLEY, M. E.

TODAY, and doubtless for some years to come, conservation of steel is a prime essential. Industrialists everywhere are faced with a steel shortage, with the result that, in addition to redoubled maintenance work on present equipment, the purchase and use of better longer-wearing replacement equipment becomes a patriotic duty.

Take the simple matter of sheaves, for example. Not especially expensive in themselves, they can, if not of the proper material, prematurely ruin wire rope which costs much more. One of the results of using sheaves of too soft a material is that the wire rope leaves its imprint in the sheave groove. Such a condition wears the sheave excessively and tends to shorten the life of the rope. Also, when a new rope is installed, it is quite unlikely that the strands of the new rope will fall in the old "tracks," or match the old corrugations. This leads to further wear of the sheave and develops a severe filing action on the new rope.

Some hold to the theory that soft sheaves will save rope by taking the abrasion themselves instead of abrading the rope. Experience does not bear this out. Hard sheaves generally maintain a smooth tread surface; soft sheaves do not, but are inclined to roughen and act as a file against the crown wires of the rope.

The roughening of sheave treads is further heightened by the tendency of some rope to "barb", which is nothing more than a projecting of jagged broken wire ends from the body of the rope. These wire ends dig into the sheave, if the sheave is soft. This trouble may be avoided by using preformed rope, since this rope does not tend to form jaggers, but rather the broken crown wires lie flat, thereby retaining the smoothness of the rope's surface. More than this, preformed wire rope has less tendency to rotate in the grooves as it passes over the sheave.

Determining Sheave Hardness

It is a simple matter to determine how hard the material of a sheave tread must be to withstand the pressure of the rope. In the usual case, the rope at all times contacts half the periphery of the sheave. Then, the bearing pressure of the rope on the sheave per square inch of projected area of the rope is obtained by the following formula:

$$P = \frac{2L}{dD}$$

P equals the maximum unit bearing pressure, in pounds per square inch of the rope against the groove tread; L equals the maximum rope tension, in pounds; D is the diameter of the rope, in inches; and d is the tread diameter of the sheave, in inches.

For 16 x 19 regular-lay wire rope, of filler wire construction, which is a common rope for industrial applications, the minimum recommended value of d/D is 26. Substituting this value in the above formula it becomes

$$P = \frac{L}{13\,D^2}$$

If the rope is of plow-steel grade, and a factor of safety of 6 is used, the value of L/D^2 becomes 13,300 for ¼-inch rope, 12,500 for ½-inch rope, and 12,000 for 1-inch rope. Taking a value of 12,500 as being fairly typical, and substituting this in the equation, we have

$P = 961$ pounds per square inch.

Consulting the table of safe unit bearing pressures, we find that this figure is far greater than the maximum bearing pressure recommended for gray cast iron, is somewhat near that for cast steel, and is much below the safe bearing pressure for manganese steel. Therefore, under the conditions given, which are fairly representative of what will be found in industry, the cast-iron sheave is plainly too soft, the cast-steel sheave will generally stand up satisfactorily under the rope pressure, and the manganese-steel sheave will stand bearing pressures that are several times higher.

If gray cast-iron sheaves are to give satisfactory service, the value of P must be considerably reduced by either increasing the size of the sheave or reducing the load on the rope.

Various Types of Sheaves

Many different types of rope-operated equipment are today being supplied with sheaves made of heat-tested cast alloy-steel containing manganese, molybdenum, or other alloying elements. A hardness of around 350 Brinell is not uncommon with these alloy-steel sheaves, which stand up satisfactorily under almost all kinds of service. Where alloy-steel sheaves must be replaced, sheaves of at least as hard and tough material should be used for replacement.

The argument has been advanced that steel against steel should be avoided, and since the rope is steel the sheave therefore should be some other kind of metal, such as cast iron or semi-steel. This argument is not supported either by theory or practice. There is no reason why the use of steel against steel is more harmful than cast iron against steel; and practice provides ample proof to the contrary.

The sheaves and drums on the hoist lines of heavy-duty cranes are particularly apt to show the imprint of the rope, unless they are made of hard, tough metal, since the lines are continually subject to the bucket load while in use. Certain other applications, such as the crowding lines of power shovels, also subject the sheaves to very heavy rope pressure.

It is important to remember that one cannot save the rope by destroying the sheaves. Contrary to what might be expected, the use of harder metal to prolong sheave life actually results in increasing the life of the rope. It is seldom that metal as soft as gray cast iron can be justified as sheave material. To get satisfactory performance from both sheaves and ropes, no metal softer than commercial cast steel should be used, and in many cases manganese-steel sheaves will save in rope and sheave replacement much more than their additional first cost.

SAFE UNIT BEARING PRESSURES OF ROPES ON VARIOUS MATERIALS IN SHEAVES
(Lb. per Sq. In.)

	Regular-Lay Ropes		Flattened Strand Ropes
Material	6 x 19	6 x 37 8 x 19	
Gray Cast Iron	500	600	[illegible]
Carbon-Steel Casting	900	1,075	1,[illegible]
Manganese Steel	250	3,000	.....

For Lang-lay ropes, the values given for regular-lay ropes may be increased 15 per cent.

The Ipco safety jacket for road crews.

Safety Vest Protects Maintenance Crews

Because of the large amount of maintenance necessary to keep our highways functioning under their wartime loads and also due to the number of inexperienced men in maintenance forces, the hazards to such crews working on the highways have increased. To provide high visibility for road workers, either day or night, and no matter at what point or under what conditions they are operating, Industrial Products Co., 2914 No. Fourth St., Philadelphia, Pa., has brought out the Ipco safety jacket in black and white checkerboard design.

Made in the form of a vest, patterned large enough to fit over regular clothing, with ample room for performing work in a normal manner, this jacket buttons in front, with a buckle adjustment in the back, and has one large pocket. The manufacturer states that the black blocks in the checkerboard pattern are woven, not painted, in fast color which does not fade from laundering.

Further information on these Ipco safety jackets may be secured by interested state and county highway departments and by contractors doing contract maintenance direct from the manufacturer. Just mention this item.

Rub-On Lubrication With Graphite Stick

A new medium-soft graphite lubricant in handy stick form has just been announced by the Joseph Dixon Crucible Co., Jersey City 3, N.J., for quick lasting rub-on lubrication of machine parts, door striking plates, chains, sticking doors, window and drawer slides, and similar uses. Formulated with high-grade unctuous flaky lubricating graphite in combination with other excellent lubricants, it comes in a stick, enclosed in a cylinder 3 inches long x 7/8 inch in diameter. Each end is provided with a disc; by pressing one disc inward, the stick is ejected to the required length for application. After using, the other disc is placed on top of the exposed stick and pushed inward.

Further information on the Slipstik graphite lubricant, which adheres to metal, wood, fibre, leather, and all hard and soft materials, may be secured by those interested direct from the manufacturer, by mentioning CONTRACTORS AND ENGINEERS MONTHLY.

Borg-Warner Appoints New Director of Engineering

The appointment of Harold T. Youngren as Director of Engineering Development has been announced by the Borg-Warner Corp., Chicago, Ill. Mr. Youngren has held the position of Chief Engineer with the Oldsmobile Division of General Motors Corp. since 1933, and previous to that served with Studebaker, Allis-Chalmers, Westinghouse, Harley-Davidson, and the Pierce-Arrow Motor Car Co., and has been an active member of the Society of Automotive Engineers for more than 30 years.

Mr. Youngren will make his headquarters in Chicago. One of his chief duties will be the supervision of the Borg-Warner research laboratories and he will cooperate with the plant engineers of the twenty Borg-Warner divisions and subsidiaries.

New Works Manager At LaPlant-Choate

The recent appointment of C. H. Lage as General Works Manager in charge of all plant operation and production has been announced by the LaPlant-Choate Mfg. Co., Inc., of Cedar Rapids, Iowa, maker of earth-moving and road machinery. Mr. Lage, who has a background of wide experience in this field, was for twelve years prior to 1941 connected with the Caterpillar Tractor Co., serving in various capacities primarily concerned with planning, general manufacturing engineering and the analysis of engineering designs. Immediately preceding his present appointment, Mr. Lage was Vice President in charge of manufacture at the Universal Unit Machinery Corp., of Milwaukee, and served concurrently as Works Manager of the Davis & Thompson Co.

Forest Service Shops Check on Equipment

(*Continued from page 61*)

24) are made at times when equipment comes to the warehouse to deliver or secure supplies.

To prevent the piling up of inspections and repairs at the branch shops and resulting delays or hurried performance, prior arrangements are made by phone before a piece of equipment is driven in to the shop from any considerable distance. If shop repairs cannot be completed in one day, a temporary exchange of units is usually arranged as no living quarters for equipment operators are ordinarily available at branch shops.

In addition to the performance of "C" services in the branch shops and field checks and inspections by their personnel, these shops are utilized for the installation of assemblies such as motors, transmissions, differentials, generators, and carburetors which have been rebuilt at the main depot. Personnel from the branch shops is utilized for making field checks to assure operators' compliance with the rules for general upkeep procedure which is their responsibility. These field checks are not made on a regular schedule but at odd intervals, with their frequency dependent on the general condition of the unit as well as the operator's personal qualifications.

Fire Services

During the emergency of a fire in a National Forest, the branch shop and its personnel render important service. Trailbuilder equipment and several fire pumps must be kept in continuous operation or ready for emergency use, and this is a responsibility of the branch shop foreman.

As soon as a fire is reported, he goes to the scene and from a study of conditions estimates the requirements to insure continuous operation of the fire-fighting equipment. He orders men from the branch shop and transfers necessary tools, parts, such as generators, tires, and batteries, and supplies for repair operations, to the fire camp. If he feels that his regular force is not adequate, he can request additional help from the main depot.

One type of rolling stock whose use and value are much increased during a fire is heavy stake-bodied trucks with built-in seats for the rapid transfer of fire-fighting crews. In addition to the transportation of laborers to critical points, the branch-shop organization is often called on to transport from airports to fire camps the trained supervisory personnel which may be brought in by air from other National Forests to aid in the emergency.

Asphalt Institute Issues Third "Progress" Bulletin

An 8-page pamphlet, No. 3 in the "Progress Pointers" series, has just been issued by The Asphalt Institute, New York City. The main feature is an interpretation of the War Production Board's new Conservation Order L-41-e, which provides that a wide range of highway maintenance and repair may now be carried on without authorization from WPB; that certain classifications of highway and street construction do not require specific WPB approval; and that approval for construction outside these limitations may be secured upon application through the State Highway Departments.

The new Institute pamphlet also includes a résumé of regulations applying to new construction; a review of progress in lifting restrictions; the procedure for figuring construction cost; the present cooperation of the Office of Defense Transportation in facilitating asphalt transportation; and a number of typical illustrations showing highway and street-maintenance operations now in progress in the various states.

Free copies of this pamphlet may be secured upon application to The Asphalt Institute, 801 Second Ave., New York 17, N. Y., or to any Institute office.

Coast Equipment Co. Takes on New Lines

Announcement has been made of the appointment of the Coast Equipment Co., 948 Bryant St., San Francisco, Calif., as distributor in northern California and western Nevada for the Wood Roadmixer, made by the Wood Mfg. Co., Los Angeles, Calif.

This company has also recently been appointed by the American Hoist & Derrick Co., St. Paul, Minn., as exclusive representative in northern California for its line of derricks, hoists, revolving cranes and fittings.

New Sales Representative For H. O. Penn Co. in N. J.

The appointment of Stanley Wardell as Advertising Manager and New Jersey Sales Representative for the H. O. Penn Machinery Co., New York City, has just been announced. Previous to his present appointment, Mr. Wardell conducted an advertising agency which specialized in direct-mail advertising and the creation of machinery catalogs, as well as magazine advertising, for such organizations as the Associated Equipment Distributors, H. O. Penn, Syracuse Supply Co., U. S. Hoffman Machinery Corp., Marlow Pumps, and the Complete Machinery Co., as well as many others.

Vermont Finds Rock-Salting Effective for Winter Roads

Snow and Ice Problems Solved Economically by Chemical Applications; Safer Driving Conditions

By H. E. SARGENT, Commissioner, Vermont Department of Highways

AS in many other states, the problem of winter maintenance on the Vermont state highway system has been complicated recently by the shortage of labor at rates of pay the state can afford. Moreover, the past winter was severe in this region, although other parts of the country had the lightest snowfalls in a decade. Snow remained on the ground in Vermont from the storm of November 22, 1943, which incidentally was one of the heaviest first-of-the-season storms in years, through March. While the northern part of the state had the heavier snowfalls, the generally favorable conditions in the southern districts were offset by wet packing snow, sleet, and freezing rain.

Although most of our equipment still appears serviceable, we have found that in tight spots the trucks do not have their original power, often when needed most, and a part of the equipment was always unavailable because of breakdowns.

In spite of the fact that general traffic in Vermont is 60 per cent less than in pre-war years, cars traveling on Vermont highways today represent essential traffic, and there is more trucking than before the war. When lower revenues from gasoline taxes and motor-vehicle receipts became inevitable, we tried to reduce winter-maintenance expenses sharply, but found that it was not possible to effect any economies without substantially impairing transportation. Fortunately, after several winters of extensive experiments, last winter we introduced rock-salt treatment on a large scale. The results were so satisfactory and the treatment so economical that we plan to continue using straight applications of salt on 1,481 miles of the state system. The number of complaints about slippery roads was inconsequential last winter, even with heavy storms, and motorists and truckers have expressed their approval of the new method of providing safer driving conditions.

Salting the Roads

Like many other communities, we were not fully prepared for the early November snow, which deposited an 18 to 31-inch blanket over most of the state. However, with rock salt applied straight on all the roads, we were able to melt off most of the ice accumulation which in previous years would have had to be sanded throughout the winter to render it skidproof to some degree. Salt seems very effective for preventing ice when it is possible to put it down early in the storm.

In the territory served by the twelve district highway commissioners, trucks are loaded with bulk Grade CC rock salt which is distributed by spreaders located on the left side of the truck. By means of a simple hopper, with a piece of 2-inch pipe attached, one man standing in the truck can spread 350 pounds of salt per mile down the center of the roadway while the truck travels in its own traffic lane at the rate of 15 to 20 miles an hour. The salt penetrates through the snow and keeps it in a mealy condition so that, even when the temperature goes far below freezing, no icy accumulations build up in the road, and the [illegible] can easily be pushed aside when the plows come through. The small amount of snow left on the road is quickly melted by the salt solution, leaving a dry safe pavement.

When, by reason of a heavy snowfall, it is not possible to get the salt down at the beginning of the storm, crews plow first and then put the salt down on the compacted snow. Whenever possible, however, we try to practice ice prevention rather than ice melting. District commissioners have found that when the bulk salt is kept in warm storage before it is loaded on the trucks, the action of the salt in removing the snow is accelerated. Since the temperature seldom goes below 20 degrees in the hours immediately following the storm, salting and then plowing during this period is most effective.

An interesting thing discovered in the use of salt is the repeat action. Small amounts of recrystallized salt left on the pavement after one storm will work up through the next snowfall and give some protection before the maintenance trucks get out to patrol their routes.

Economy and Safety

Because salt requires less man-power for spreading than sand, and because one application of salt yields bare pavement, while repeated abrasive treatments are necessary to safeguard ice-coated stretches of highway, there has been a noticeable saving in highway funds. This economy is most welcome, because expenditures as of February 15 were running $30,000 ahead of previous years, principally because of increased labor costs.

In spite of two heavy winters and with only 500 men, the roads were in much better shape than with previous snow-removal techniques when 800 men were available. The volume of abrasive has been cut considerably and its use is now confined principally to hills and curves. No extra help was available for sanding operations last winter. With clear rock-salt treatment, there is less stockpiling, and savings are also made in this item.

New Hampshire's use of rock salt has been followed by the Vermont Department of Highways with interest and, coupled with the results of our comprehensive tests, indicates that it solves the most difficult maintenance problem in these northern latitudes. By reducing the volume of accidents caused by slippery roads, which for a number of years has been the leading cause of property damage and highway accidents in Vermont, rock salt makes a great contribution to safety.

"There was a time, not so far back, when there were more men working for the Army under general contractors than there were men being drilled under general officers."

—*Lieutenant-General Brehon B. Somervell*

Russell W. Ward, Inc., of Palmyra, N. J., recently obtained releases for the purchase of three International KB-11 motor trucks, one of which is shown taking a load of sand from the concern's sand and gravel plant. This company, which was organized in 1939, operates a fleet of fifteen trucks, all but two of which are Internationals. Russell W. Ward is President and Fred T. Klein, General Manager.

Beach Erosion Control Discussed at Meeting

Speaking in a symposium on types of shore protection structures at the Sixteenth Annual Meeting of the American Shore and Beach Preservation Association, held in Chicago recently, R. J. McIntosh of the Bethlehem Steel Co. discussed various studies of the use of coated and untreated steel sheet piling in the construction of groins to prevent beach erosion. Mr. McIntosh pointed out that in some locations groins in the ocean are subjected to severe abrasive action of the sand moving in the water, and have deteriorated sooner than expected.

To assist in the study of this matter, the steel sheet piling industry in 1937 donated sufficient piling to the United States Beach Erosion Board to construct four test groins at Palm Beach, Fla., where abrasion is particularly bad. Both deep-arch and straight-web sections were used to determine whether the abrasive action was affected by the shape of the piling sections. A recent report indicates that the shape of the section apparently has little effect on the abrasion, which was sufficient to cause small holes through the unprotected piling in slightly more than three years in the deep-arch sections and in four years in the straight-web sections of the same 3/8-inch web thickness.

Mr. McIntosh stated that steel sheet piling should be well suited to form permeable groins by driving down occasional piles below the general grade to provide gaps for the passage of water. On the basis of the report referred to above, good results in preventing abrasion of the steel have been obtained by sheathing the groin with creosoted timber planking, which seems to be the only practical and effective method yet devised to resist abrasion.

In studying this subject of abrasion, consideration has been given to the abrasive-resisting steels such as are used in chutes, buckets, hoppers, and similar equipment subjected to hard wear. These steels derive their abrasive resistance from their quality of hardness and since, Mr. McIntosh said, these steels are not very much harder than the steel used in sheet piling, the extra cost and manufacturing difficulties involved in their use do not seem justified.

Tests made by the British Institution of Civil Engineers indicated that the presence of mill scale accentuated the tendency to localized corrosion and pitting, and that the apparent advantage of copper-bearing steel in aerial corrosion was not observed in the half-tide and complete immersion tests in sea water. Also, these tests showed little difference in the corrosion of any of the ferrous metals tested, which included various kinds of cast iron, steel and wrought iron, with the exception of the very expensive nickel chrome alloy steels.

Comprehensive tests by a steel company at locations in Massachusetts, Maryland, Florida and California to determine the reactions of various protective coatings for steel subjected to sea-water exposure indicate that the following provided the best protection:

1. A thick coat of coal-tar pitch enamel, applied hot over a priming coat of coal-tar pipe-line primer.

2. A priming coat of zinc-chromate iron oxide paint having a Bakelite vehicle, and two additional coats of aluminum paint having a Bakelite vehicle. These paints were made in accordance with specifications provided by the Bakelite Corp.

One of the purposes of these tests was to determine what coatings were effective against barnacles and other destructive varieties of shell fish, and the coatings mentioned were also the most effective for that purpose.

Hyster Co. Appoints Two Vice Presidents

Frank L. Ross, Manager of the Hyster Co. Eastern Division in Peoria, Ill., has been named a Vice President and member of the Board of Directors of that organization, according to a recent announcement. Mr. Ross will continue to have his headquarters in Peoria, directing the activities of all mid-western and eastern programs of the company.

Eugene Caldwell, General Manager of the company at its headquarters, Portland, Ore., has also been named a Vice President.

U. S. Engineers Photo

A sample of the terrain and difficulties which faced the Americal Division Engineers at Bougainville. A bulldozer, bogged down in a swamp while blazing the way for a jungle road, is given a helping hand by a tractor-mounted crane.

Army Engineers Lick Jungle Road Building

(*Continued from page* 42)

for such emergencies. Says M/Sgt. William E. Jones, Elizabeth City, N. C., "If we can't replace a part, we make one." Acetylene welding outfits mend damaged parts almost in less time than it takes to break them.

The Americal Engineers have four dirt-moving scrapers on the job and these were used to place the fill on the roadway, which was then spread by motor graders. Road surfaces are always several feet at least above the surrounding terrain, and both sides are ditched by the scrapers. The presence of so much surface water makes numerous culverts necessary. Gasoline drums, with both ends knocked out, and buttressed by timbers to keep the weight off the thin-walled drums, carry the flood water under the roadway, preventing washouts.

And so, past the site of an old native village, and over ridges so steep that in 12 feet the grade dips down 50 feet, the road was pushed through what was formerly the heart of Jap-held territory.

One of the Problems

Surveying for such routes is pretty sketchy; the road is routed the easiest way possible. First Lt. George S. Gerst, of Pittsfield, Mass., S-2 for the Americal Engineers, led quite a few parties, including riflemen for protection, into the jungle to determine the approximate course of the road. At one point he found a strip of soft sticky clay 200 yards wide, with no way to get around it. All the mechanized equipment was stymied; here was a job for man-power. The only way to pass over the area was to corduroy it. This meant first that logging crews must saw and split logs of suitable length; second, the timber must be loaded and hauled to the job; and third, a crew of men had to paw around in the muck to set the logs in place.

In some cases, instead of felling trees, dynamite charges were set off beneath the spreading roots, then bulldozers shunted the fallen trees to one side where the logging crew salvaged what they needed. Later, the excess logs were hauled to the Bougainville sawmill to be turned into lumber.

Other Bridges

Five bridges have been constructed, thus far, on this route. The Torokina is the largest, and the others span several branches of the Texas River. Though high banks had to be broken down, the Texas was easier to tame than the Torokina. Number 1 and 3 bridges beyond the Torokina were constructed by 93rd Division Engineers. Number 2 bridge bears the name of First Lt. William J. Boteler, Washington, D. C., under whose direction it was built.

U. S. Engineering "Know How"

In two years, the Japs were able to build only muddy trails in this Empress Augusta Bay sector, suitable for small vehicles over some of their length but for the most part used only by carrying parties. In five months, many miles of intersecting, heavily traveled highways and numerous bridges have been built by American Engineer troops, in addition to three air strips, and parking and recreation areas. Americal Engineers alone laid 25 miles of roadway.

When the contributions of various groups are totaled up at the war's end, a large slice of credit will go to the Engineers for their work in the lonely islands of the Pacific. The startling and impressive fact, however, is the brief time required for their prodigious efforts. Starting on the American bank of the Torokina, the Engineers built five bridges and about 5,000 yards of highway in about two weeks. So far as they know, there is only one way to win the war, and that's to build roads straight to Tokyo.

Derrick Co. Changes Name

The American Hoist & Derrick Co. of St. Paul, Minn., has announced a change in the name of its subsidiary, the American-Terry Derrick Co., South Kearny, N. J., to the American Hoist & Derrick Co. Plant No. 2.

Coming Publications On Highway Research

The war has stimulated rather than retarded research in many phases of highway work. In addition to research for direct war needs, it has been realized that the future welfare of the country requires continual technological advance of all kinds. The increased activities of highway technologists have found expression in three forthcoming publications of the Highway Research Board, which include the Proceedings, Roadside Development Reports, and Wartime Road Problems.

The Proceedings, which will be ready this month, will contain the various papers and discussions presented at the Twenty-Third Annual Meeting held in Chicago, Ill., last November, and cover the subjects of highway economics, design, materials and construction, maintenance, traffic and operations, soils, and aerial photography. The Roadside Development Reports present the Divisional Committee reports made at the Annual Meeting on design, right-of-way and border control by W. H. Simonson, Senior Landscape Architect, Public Roads Administration; construction and maintenance by John L. Wright, Director, Bureau of Roadside Development, Connecticut State Highway Department; and education, evaluation and public relations, by Professor P. H. Elwood, Head of the Department of Landscape Architecture, Iowa State College. The appendices of these Roadside Development Reports include a wide variety of material of interest and value to Roadside Development engineers.

In the series of bulletins on wartime road problems, eight are now available, covering concrete curing, design of highway guards, design of concrete pavements with minimum use of steel, maintenance methods for preventing and correcting the pumping action of concrete pavement slabs, granular stabilized roads, patching concrete pavements with concrete, use of soil-cement mixtures for base courses, and thickness of flexible pavements for highway loads. Those in preparation will discuss the treatment of icy pavements, salvaging old high-type flexible pavements, compaction of subgrades and embankments, and soil-bitumen roads.

Volume 23 of the Proceedings is available at $3.50 a copy. The Roadside Development Reports are priced at $1.00 per copy, while the Wartime Road Problems bulletins range from 10 to 25 cents a copy. Orders for any of these publications should be addressed to the Highway Research Board, 2101 Constitution Ave., Washington 25, D. C.

New Madsen Dealers

Madsen Iron Works, Huntington Park, Calif., announces the appointment of the Herman M. Brown Co., Des Moines, Iowa, as its distributor in Iowa, and General Equipment Co., San Leandro, Calif., as a distributor in northern California, for the complete line of Madsen road construction equipment. This line includes portable asphalt paving plants, oil-mix plants, gravel-mix machines, concrete finishers, batching plants, rubber-tired rollers, and other construction equipment. This announcement is in keeping with the Madsen post-war plans to distribute nationally through established equipment dealers.

Heavy Flood Damage To Roads in Missouri

(*Continued from page 62*)

ern Missouri. Two 30-foot approach spans of the bridge were washed one-half mile down stream. One steel-pile pier supporting the 160-foot high truss main span was washed out, so that the end of the truss dropped into the river. The steel-pile pier at the other end of the main span was badly twisted. This was an old county-built bridge, which had been taken over by the State Highway Department. The repair cost estimate was so high that the decision has been made to construct an entirely new bridge at this location.

Damage in the form of a wash which exposed the top of the piling under the footing of a pier occurred at a bridge over the Missouri River at Courtney Bend, some 5 miles south of Liberty on Route 71 By-Pass. This condition was taken care of temporarily by filling the hole around the pier with sand bags. A pontoon bridge was built, by using old oil barrels, to provide a way to get the sand bags from the river bank to the pier. A home-made device was constructed to fill the bags with sand. This saved a very considerable amount of labor as well as speeding the work.

Regular Crews Make Repairs

Floods have added many problems and difficulties to be overcome in the satisfactory maintenance of state highways in Missouri during 1944. Especially is it critically affected by the manpower problem. During normal times, emergency repair work is handled in the most part by the employment of additional labor, but at this time additional labor was not available. This made it necessary to use the regular maintenance crews on emergency flood repairs and, as a result, our routine maintenance throughout the flood area had to suffer a let-down.

Report on Short Course On Highway Development

A 73-page mimeographed report, paper-bound, of the proceedings of the Fourth Short Course on Highway Development, held at the Ohio State University March 10 and 11, has just been issued. It contains the complete program of each session, and the papers and discussions presented. The theme of the conference was "The Complete Highway" and the subjects presented for discussion covered a wide range, including wartime highway problems of the present, public relations, highway research, roadside development, and various phases of post-war highway planning.

Copies of this report may be secured by interested highway engineers and officials by writing to Charles R. Sutton, Department of Architecture and Landscape Architecture, Ohio State University, Columbus 10, Ohio, or to Dallas D. Dupre, Jr., Landscape Architect, Ohio Department of Highways, Columbus 15, Ohio.

INDEX TO ADVERTISING

Contractors and Engineers Monthly

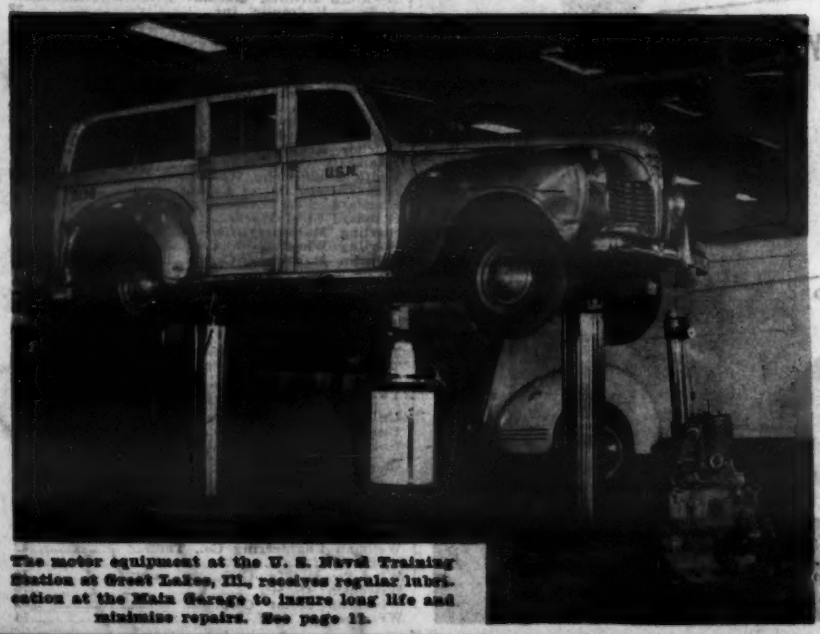
C. & E. M. Photos

At left, a 4-inch hot-mix gutter, 12 feet wide, was laid along the edge of taxiways at Stewart Field, N. Y., by an Adnun Black-Top Paver, and raked out by hand to a width of 13 feet. Above, construction field personnel on the project for the expansion of facilities at Stewart Field: left to right, Lieut. J. J. Jago, U. S. Engineers; and T. P. McFarlin, Field Engineer, Felix Petrillo, Vice President, and John McFall, Superintendent for Mt. Vernon Contracting Co., Mt. Vernon, N. Y. See page 1.

Typical excavation sheeting for trench for 54-inch pipe on the V. Barletta Co. contract on the Bridgeport, Conn., wartime sewer project. The tile pipe shown is for the underdrain. See page 17.

A Cleaver-Brooks tank-car heater is used by the maintenance forces of the North Dakota State Highway Department to supply steam for thawing culverts. See page 29.

A general view of the new steel arch hangar for the Air Transport Command at the Washington, D. C., National Airport, when five of the eleven panels had been partly completed. See page 37.



The motor equipment at the U. S. Naval Training Station at Great Lakes, Ill., receives regular lubrication at the Main Garage to insure long life and minimize repairs. See page 11.

Bureau of Reclamation Photos

Top photo, water entering the inlet end of the old railroad tunnel through Shasta Dam in California during its use as a river diversion tunnel. Lower photo, the outlet end. Plugging this tunnel was one of the recent operations in this mammoth conservation project. See page 2.